JAN 3 1945
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AAF 1st MOTION PICTURE UNIT
CULVER CITY, CALIFORNIA

Research

RESTRICTED

ANTIAIRCRAFT FIELD MANUAL

SERVICE OF RADIO SET SCR–545

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON 25, D. C., 8 NOVEMBER 1944.

FM 4–146, 2 November 1943, is changed as follows:

■ 2. REFERENCES (Superseded).—See appendix XII.

* * * * *

■ 4. GENERAL OPERATION.—*a.* The SCR–545–A contains * * * a track system. The SEARCH system provides a **broad** antenna pattern which is useful for two purposes. First, it is * * * approach of aircraft. Second, it is very useful in **putting the TRACK system on target as well as maintaining radar contact with** a target that has been lost from the narrow beam pattern of the TRACK antenna. The TRACK system * * * necessary for hits.

* * * * *

■ 5. COMPLETE EQUIPMENT.—*a.* Figure 1 shows the **prime mover** and trailer comprising the SCR–545–A. Two 2½-ton van body **spare parts** trucks and one 2½-ton cargo truck are provided in the field per gun battalion for carrying spare **components,** parts, and accessories.

b. For situations where a supply of **220-volt, 3-phase,** 25-cycle commercial power is available, another van may be supplied with each SCR–545–A. This converter van carries a motor-generator set to convert the 25-cycle power to 60-cycle, **single-phase, 120-volt** power.

■ 12. OPERATOR'S CONTROL UNITS.

* * * * *

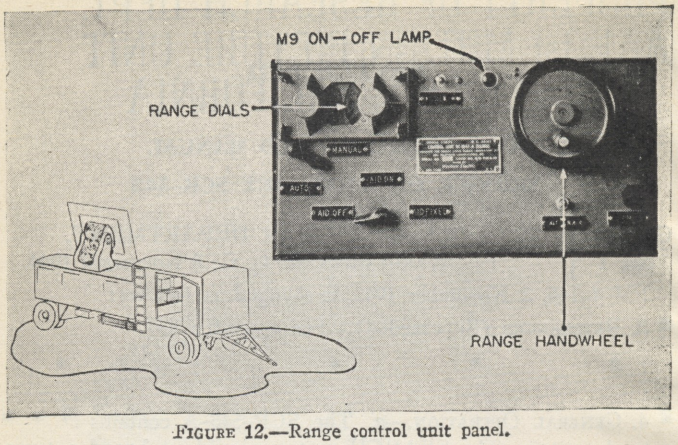

FIGURE 12.—Range control unit panel.

b.

* * * * *

(7) (Superseded.) *M9 ON-OFF Lamp.*—A lamp that indicates the position of the *Data Flow Switch.* This lamp lights when the *Data Flow Switch* is in the "M9-OFF" or "M4-M7 SL R" position.

NOTE: A modification kit has been issued which changes the location of the *Auto Fade lamp* to just above the AUTOMATIC TRACKING SWITCH on the junction box shown in figure 17.

(8) *Data flow switch.*—If the director * * * in the "off" position. *It must always be "off" when slewing the SCR-545-A in range* ***or when rapidly moving the antenna in azimuth or angular height to avoid sending abnormal rates to the director. Normally, it should be left in the "off" position until the radar is "on target."*** If the director **used** is an M4 or M7, this switch operates to position the altitude transmitter either to correspond to altitude or to slant range as desired. **On the early mounts the switch nameplate is reversible. For M9 or M10 directors this nameplate should have the ON M9 OFF side showing.** For M4 or M7 directors the reverse side of this nameplate which is marked ALTITUDE-SLANT RANGE, should be used.

* * * * *

■ 13. RECEIVER CONTROL UNITS.

* * * * *

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e. (Added.) The gain control selector switch and gain controls operate as explained above only when the GAIN CONTROL SELECTOR switch on the receiver panel is set to "remote."

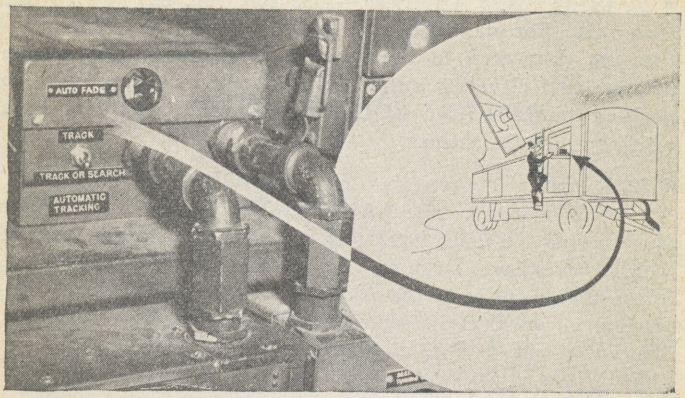

FIGURE 17.—Automatic tracking switch and auto fade lamp.

■ 15. AUTOMATIC TRACKING SWITCH **and Auto Fade Lamp.**— The AUTOMATIC TRACKING * * * SEARCH system signals. **The change from TRACK system signals to SEARCH system signals is indicated by lighting of the "Auto Fade" lamp (fig. 17).** If the TRACK * * * the TRACK system. While operating from SEARCH system signals, the angular height of the antenna is not automatically controlled, **therefore the elevation operator *must* track in MANUAL whenever the "auto fade" lamp is "on."**

■ 16. HIGH VOLTAGE RECTIFIER.—This unit supplies * * * the trailer cab. Paragraph 39 outlines the starting procedure and the sequence of the light signals **observed** at the switchboard. The VOLTAGE ADJUSTMENT shown on the main switchboard in figure 44 is a fine adjustment to permit small changes in d-c output of the HIGH VOLTAGE RECTIFIER **and is normally left in a fixed position. This setting affects the shape of the transmitted pulse and should be determined by the radar**

repairman. The HIGH VOLTAGE RECTIFIER should not be operated below 9,000 volts to prevent possible damage to the equipment.

■ 20. INPUT SERVO AMPLIFIER.—This unit (fig. 22) * * * the trailer cab. **For manual operation,** the outputs from these amplifiers **are connected to the range spinner motor and to the azimuth and elevation output servo amplifiers respectively, to position the RANGING EQUIPMENT and** control the motors which position the antenna.

■ 22. RANGING EQUIPMENT.—The RANGING EQUIPMENT * * * in figure 24. The **RANGE UNIT, which is the** upper unit, controls the range notch (fig. 50) on the oscilloscope screens, which is positioned by means of the RANGE HANDWHEEL in the trailer cab or by the AUTOMATIC CONTROLLER depending on whether the control is set for manual or automatic. The lower unit * * * in certain directors.

■ 24. SEARCH TRANSMITTER.

* * * * *

c. (Added.) The SEARCH TRANSMITTER tubes require a blast of cooling air at all times while the filaments are energized.

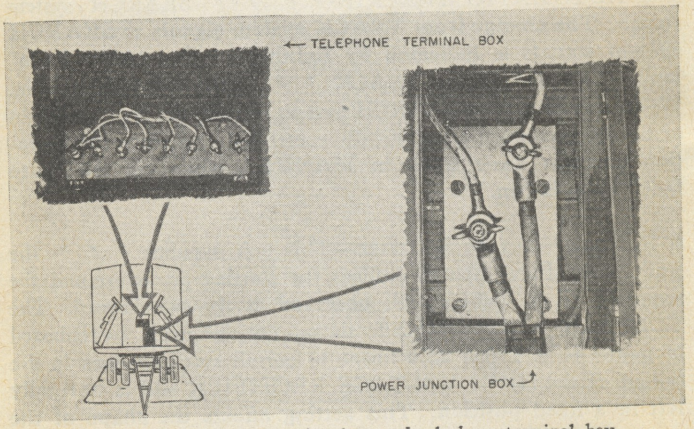

FIGURE 29.—Power junction box and telephone terminal box.

Therefore, the equipment should not be energized while the transmitter is partly out of its cabinet. This precaution also applies to the TRACK TRANSMITTER.

■ 25. ANTENNA.—The SEARCH and * * * *pip matching* method. **The transmission line connections between the ANTENNA AND TRANSMITTERS should be inspected to insure that all connections have been properly made and couplings tightened.**

* * * * *

■ 26. CABLE RECEPTACLES.

* * * * *

b. Power supply.—The 250-foot * * * behind the door.

NOTE: **There is a toggle switch in the bottom of the POWER JUNCTION BOX which turns the trailer blackout lights "on" and "off".**

c. (Superseded.) *Telephone and signaling.*—The telephone and signal cables are connected to terminals located in the TELEPHONE TERMINAL BOX (fig. 29). The extreme left pair of terminals (#107 and #108) are connected directly to the "SIG" terminals on the POWER PANEL; the other three pairs of terminals are connected through the "talk" switches on the POWER PANEL to the "TEL" terminals. The "TEL" terminals on the POWER PANEL connect through trailer wiring to a pair of terminals on the ANTENNA near the spotter's seat.

d. Data supply.—The data provided * * * at receptacle B. **When the DATA SELECTOR SWITCH is set to the "OFF" position all voltages are removed from the slant range and elevation potentiometers. With the switch in this position, these potentiometers may be adjusted by using an ohmmeter.** At the bottom of the box is a TOGGLE SWITCH which has two positions, *local* and *remote*. This switch controls the energy supply to the synchronous repeater fields and is used in the *remote* position for all cases where synchronous data are sent to or received from other equipment. **Care must be taken that the TOGGLE SWITCH is *not* in the *local* position when the data cables are plugged into M4 or M7 directors or M9 tracker in order to prevent possible damage to the synchros and director.**

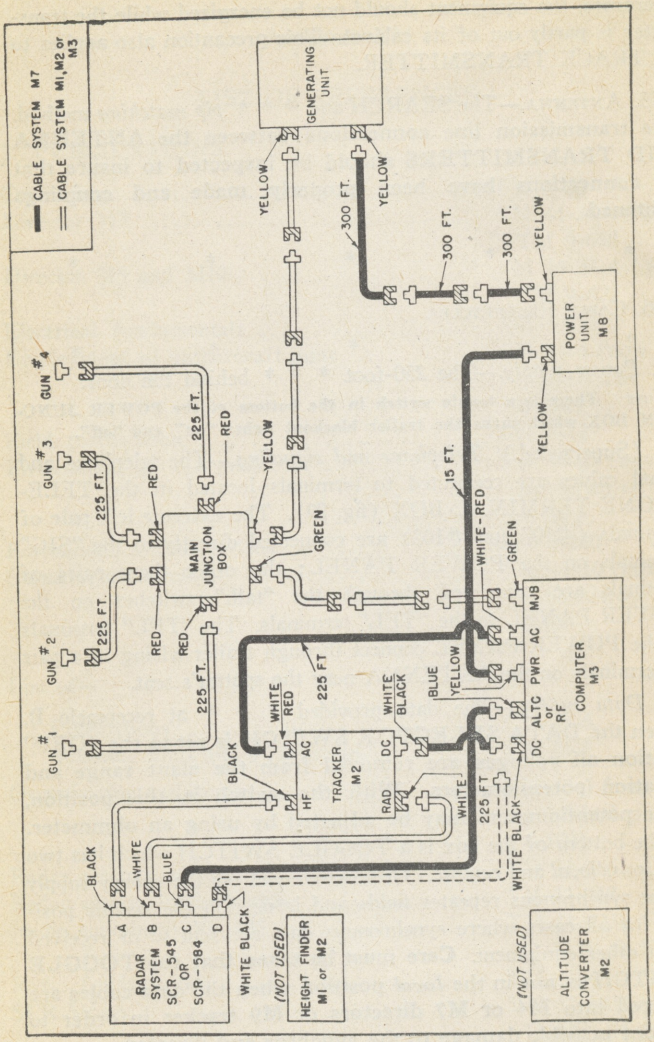

FIGURE 33.—Cabling with M9 Director for either optical or radar tracking.

■ 27. EXTERNAL DATA CABLING.

* * * * *

c. With director M9 ***(or M10).***—(1) Figure 33 shows the recommended cabling for the SCR-545-A with the director M9. The "A" (black) receptacle on the radar **is connected** to the "HF" (black) receptacle on the tracker of the director. The "B" (white) receptacle on the radar **is connected** to the "RAD" (white) receptacle on the tracker of the director. The "C" (blue) receptacle on the radar **is connected** to the "RF" (blue) receptacle on the computer of the director. The "D" (black-white) receptacle on the radar **has a cable connected which is laid to** the computer of the director. **The plug at the computer is left near the "DC" (black-white) receptacle. The "DC COMP" (black-white) receptacle at the tracker is connected to the "DC" (black-white) receptacle on the computer.** With this cabling * * * or radar tracking. For **optical** tracking, the cable is left as shown. For **radar** tracking, the loose cable is plugged into the "DC" (black-white) receptacle at the computer instead of the **"DC"** cable from the **tracker** which is shown plugged in in the figure. When using either for * * * either set-up. **For optical tracking the tracker should normally be located about 30 yards from the radar. If the radar and tracker are placed closer together the field of vision of the tracker may be impaired, and if they are placed farther apart, the slant range error introduced may be excessive.**

NOTE: **No correction for this offset error can be made on the computer.**

(2) It is possible * * * connecting the tracker. This would be accomplished by merely connecting cable "D" (black-white) from the DATA JUNCTION BOX to the DC (black-white) receptacle on the computer **(fig. 34)** setting the DATA SELECTOR SWITCH (fig. 31) at M9 and the TOGGLE SWITCH (fig. 31) at LOCAL. Under normal conditions * * * 33 is used.

(3) Rescinded.

(4) When switching from * * * the parallax change. For optical tracking parallax is figured "director **(tracker)** from guns." For radar tracking parallax is figured "radar from guns."

d. (Added.) *With director M9 (or M10) using the Cloud Switch.*—(1) Figure 35 shows the cabling for the SCR-545-A and

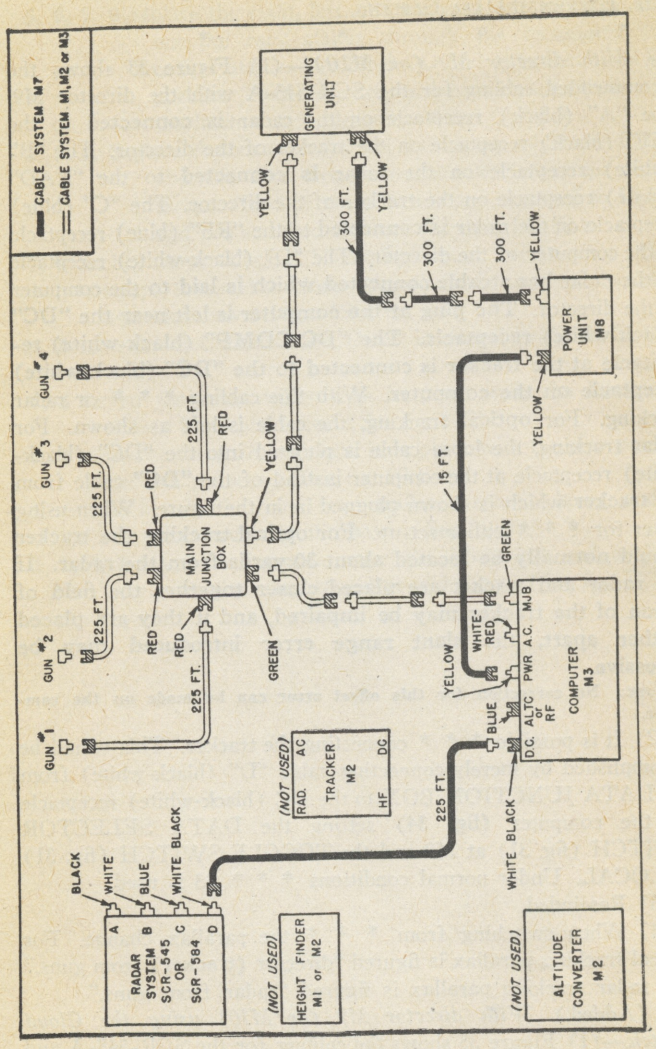

FIGURE 34.—Cabling with M9 Director for radar tracking only.

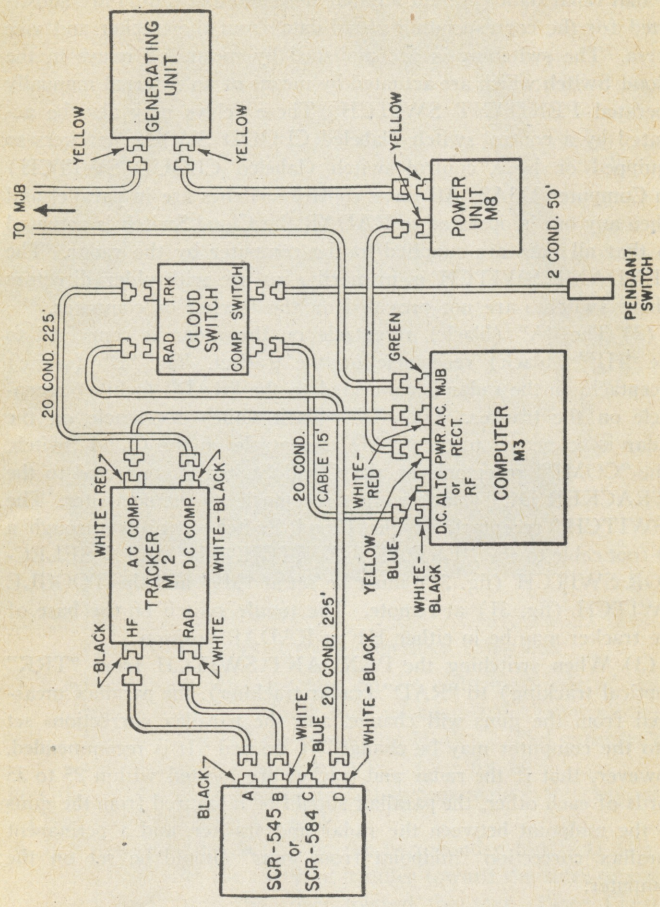

FIGURE 35.—Cabling with M9 Director using the cloud switch.

director M9 and M10 using the Cloud Switch. This arrangement allows the incoming data circuits of the director to be switched so that radar data (present angular height and azimuth) are substituted for the corresponding visual data from the tracker and vice versa. The switching is accomplished by means of relays in the Cloud Switch which are actuated by means of an external manually operated PENDANT SWITCH. These relays may also be actuated by a control switch (labeled CLOUD SW) on trackers so equipped or by a control switch (labeled CLOUD SWITCH) on Computer M3A2. All these control switches are in parallel and when any one is operated to RADAR the Cloud Switch is actuated so that all data are supplied to the computer by the radar. The PENDANT SWITCH is primarily for use with older directors where switches are not provided on the tracker or computer.

(2) The "A" (black) receptacle on the radar is connected to the "HF" (black) receptacle on the tracker. The "B" (white) receptacle on the radar is connected to the "RAD" (white) receptacle on the tracker. The "D" (black-white) receptacle on the radar is connected to the "RAD" receptacle on the Cloud Switch. The "COMP" receptacle on the Cloud Switch is connected to the "TRACKER DC" (black-white) receptacle on the computer. The "SWITCH" receptacle on the Cloud Switch connects through a 50-foot cable to the PENDANT SWITCH. The DATA SELECTOR SWITCH (fig. 31) must be set at "M9" and the TOGGLE SWITCH (fig. 31) at remote. The toggle switch on the base of the tracker may be in either HF or RADAR position.

(3) When switching the PENDANT SWITCH from "TRK" (optical tracking) to "RAD" (radar tracking), the parallax measured from the guns will change, and the parallax corrections set into the computer may be changed if desired. It is recommended, however, that if the radar and tracker are located within 25 to 35 yards of each other, the parallax should be measured from the guns to the midpoint between the radar and tracker, and a permanent parallax correction "midpoint from guns" should be set on the computer.

■ 28. DATA LIMITS.—*a. Directors M4 and M7.*

* * * * *

(2)

* * * * *

(*b*) *Elevation (angular height).*—Transmitted by a * * * and +1600 mils. **The transmitter is geared to the director telescopes and the repeater is geared to the target designation dial such that the dial revolves at the rate of one revolution for each 6400 mil change in angular height of** the director telescopes. It is used for target designation at the SCR–545–A.

* * * * *

c. Director M9 or M10 (tractor used).—(1)

* * * * *

(*b*) *Slant range.*—Transmitted as a voltage proportional to slant range between the limits of **0** and 28,000 yards.

* * * * *

d. Director M9 or M10 (tractor not used).

* * * * *

(1) *Altitude* (H_o).—Transmitted as a voltage proportional to altitudes between the limits of **approximately — 5,400** and 28,000 yards.

(2) *E–W component* (X_o).—Transmitted as a voltage proportional to X_o between the limits of **0** and 28,000 yards.

(3) *N–S Component* (Y_o).—Transmitted as a voltage proportional to Y_o between the limits of **0** and 28,000 yards.

CHAPTER 2

EMPLACING

SECTION I

CHOICE OF POSITION

* * * * *

■ 31. EXTERNAL POWER SOURCES.

* * * * *

b. As noted in paragraph 9, a converter van may be furnished for locations where the only available commercial supply operates at 25 cycles, **220 volts, 3-phase.**

SECTION I½ (Added)

CLUTTER AND COVERAGE DIAGRAMS

■ 31.1 GENERAL.—*a.* Certain general principles will be followed to locate the SCR–545–A to obtain the least amount of interference between mounts and from fixed echoes. However the suitability of any location for radar pick-up and tracking cannot be verified until actual tests of pick-up and tracking conditions in the particular location have been made. For verifying the suitability of a radar location, the use of clutter and coverage diagrams will be a definite aid. (See TF 4–1323, Siting of Gun Laying Radar Sets.)

b. The construction of clutter diagrams will show the number of fixed echoes obtained from a particular site. The size and location of these fixed echoes will be shown in map form. The restrictions in coverage occasioned by the shielding effect of nearby terrain features and other obstacles may be seen from the coverage diagram. The range at which a target flying at a certain altitude comes into view is also shown on this diagram. Study of the clutter and coverage diagrams will show the good and bad points of the site selected. Corrective action may be indicated to relocate the radar where fixed echo or coverage conditions are better. It is not expected that a perfect site can be selected at all times. A compromise between desirable characteristics is usually necessary.

Within the area in which a battery must be emplaced, the best site must be chosen.

■ 31.2 CLUTTER DIAGRAMS.—*a.* Figures 36.1 and 36.2 show sample clutter diagrams for the SEARCH and TRACK systems, respectively, for a specific site. The cross hatched portions indicate areas in which fixed echoes appear at various angular heights. The diagrams are made on polar coordinate paper with azimuth marked every 200 mils and slant range circles at intervals of 5000 yards. The clutter diagrams then represent a map showing every fixed echo that occurs in the range of the equipment. Since the SEARCH system uses a wider antenna beam than the TRACK

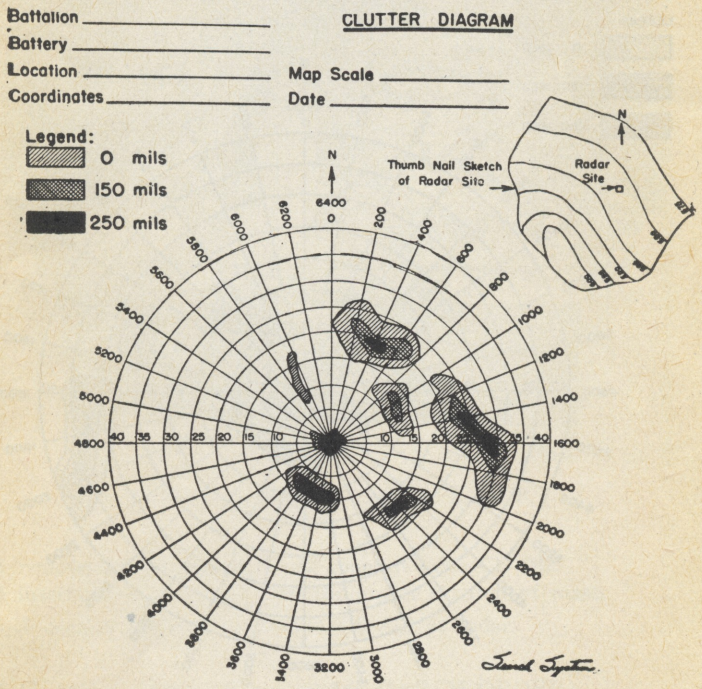

FIGURE 36.1—Clutter diagram (search system).

system, the clutter diagrams for the two systems will be, in general, somewhat different. The TRACK system clutter diagram is most important when considering the suitability of the site for tracking, while the SEARCH system clutter diagram is most important when considering the suitability of the site for pick-up.

b. The construction of the clutter diagrams is as follows:

(1) The antenna is set at 0 mils angular height and the echoes in

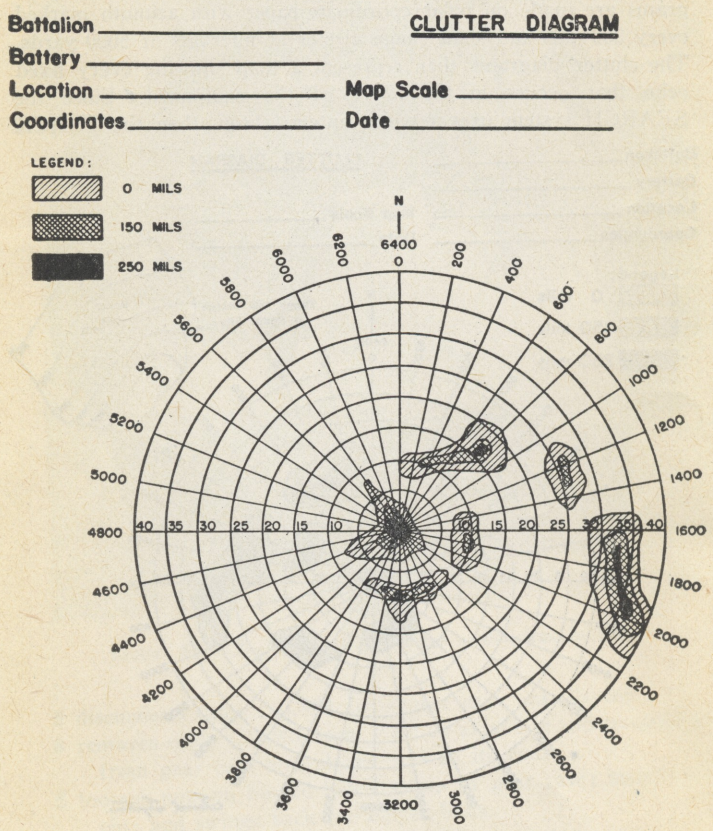

FIGURE 36.2—Clutter diagram (track system).

both systems are plotted on separate graphs for each 200 mils in azimuth. The range to the far and near edges of each area in which fixed echoes occur are plotted. The range is determined with sufficient accuracy by setting the left edge of the range notch under the near edge of the area of fixed echoes and then under the far edge. These points are then connected by a continuous line as shown in figures 36.1 and 36.2.

NOTE: **It may be necessary to take readings in between the 200-mil increments in azimuth to determine whether the object covering the fixed echo is continuous or a spot.**

(2) The antenna is then elevated to 150 mils and the above procedure repeated.

(3) Repeat the process using 250 mils angular height of the antenna.

(4) In normal situations, there should be no fixed echoes that will cause interference above 250 mils. However, if fixed echoes persist, they should be plotted for each 50 mils above 250 mils angular height until they no longer constitute interference.

(5) In plotting, operate the SEARCH and TRACK receivers under manual gain control, and adjust the gain until the "grass" or noise on the oscilloscopes is about 25 percent of the height of the main pulse. Plot as interference all echoes which are 30 percent or more of the main pulse height.

■ 31.3 COVERAGE DIAGRAM.—*a.* Figure 36.3 shows a coverage diagram for a specific site. The contours indicate the slant range at which the radar can pick up a target flying at the altitude shown on the contour line. For example, a target flying directly toward the radar from the north at 10,000 feet altitude can be detected at approximately 37,000 yards slant range. However, a target flying from the same direction at 5,000 feet altitude will not be picked up until it is at 18,000 yards slant range.

b. The construction of the coverage diagram is as follows:

(1) At the radar position, determine the angular height of the horizon at each 200-mil point in azimuth. This is done by sighting through the orienting telescope on the antenna.

(2) Calculate the slant ranges for each angular height measured for 5000, 10,000 and 15,000 feet altitude, using either of the range conversion charts in appendix IV.

(3) Plot the slant ranges for a particular altitude on the azimuth rays and join with a smooth line. Label the contour with the altitude in feet.

(4) Plot the slant ranges for other altitudes in the same manner. Draw in the contour lines and label according to altitude.

Battalion_____ **COVERAGE DIAGRAM**

Battery_____

Location_____ **Map Scale**_____

Coordinates_____ **Date**_____

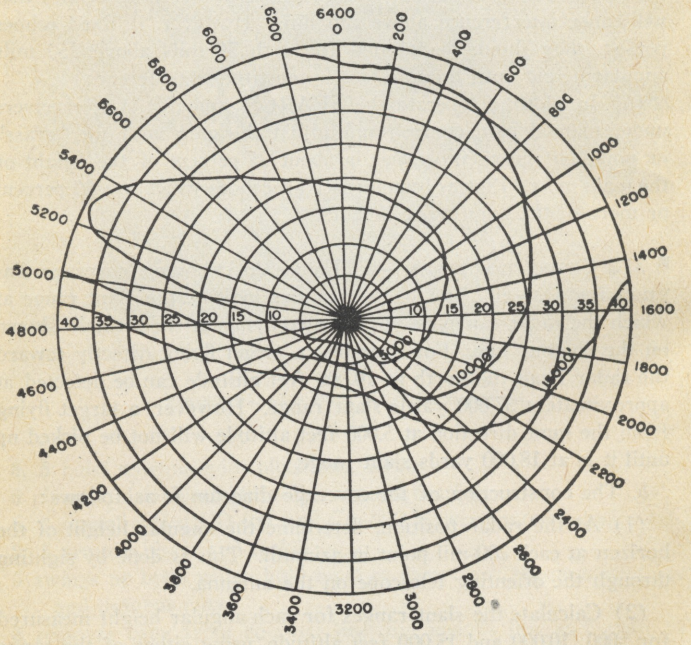

FIGURE 36.3—Coverage diagram.

(5) The altitude levels chosen are optional. They should be chosen according to existing requirements in a particular area. Additional contours, if desired, may be drawn by taking proportioned parts of the intervals between contours already drawn. The diagram should be kept as simple as possible.

■ 31.4 ANALYSIS.—*a.* Both the clutter and coverage diagrams must be used in analyzing the suitability of a site. The final decision as to whether a site is satisfactory is based on what the diagrams show and an estimate on whether any improvement could be expected from shifting the site.

b. Analyzing figures 36.1, 36.2 and 36.3 the following should be noted:

(1) The coverage to the NW, N, NE, and E in general is excellent but in the NE and E sections there is so much clutter that tracking will be poor in these sections.

(2) Coverage to the SW, S, and SE is poor. A target at 10,000 feet altitude can approach from the south to within about 5,000 yards of the radar without being detected. However, due to shielding, the clutter in these areas is not too bad.

(3) If the primary mission of this radar is to search in the areas where the coverage is excellent (4,800 mils to 2,000 mils) the site is passable, although tracking difficulties will be encountered in the areas between 400 mils and 2,000 mils.

(4) If the sector assigned to this radar consists of the area from 4,800 mils to 400 mils the site is excellent from both coverage and clutter standpoints.

(5) If the search area of this radar is to the W, SW, S, and SE (1,800 to 4,800 mils), this is a poor position and immediate steps should be taken to relocate the radar and improve the coverage.

(6) Further reconnaissance may not locate a more suitable location. In this case, the limitation on coverage must be recognized and other radars so sited as to cover the blind area of this radar.

■ 34. EMPLACING TRAILER.

* * * * *

h. Open and fasten * * * the operating position. **Remove the spotter's seat from the traveling position and install in the operating position.**

i. Release the antenna from traveling position by **loosening** the four locking screws (fig. 38) from the **four shock mounted supports.**

j. Operate the antenna crank (fig. 28) to raise the antenna to about a three-quarter erect position. **A crew member should be on the roof to observe that no damage to the plexiglass cylinder and scanner (fig. 27) occurs as the antenna is being raised.**

k. Set the TUNING PLUG (fig. 27) at **the setting indicated in the log book accompanying the mount.**

* * * * *

u. Remove the four jack plates from their carrying racks on the front and rear of the trailer (fig. 4). Place these foot plates in approximate position to receive the jack spindles. **Clean out the cups in the jack plates and put a few drops of oil in each. Loosen the dirt under each plate to get even distribution of pressure.**

v. Remove the eight outrigger braces from their brackets at the sides of the trailer (fig. 4). Install two braces at each outrigger. **Tighten all nuts firmly.**

* * * * *

aa. With the levels * * * a perfect level. Coarse levels are located on the front of the trailer and on the antenna pedestal where they are visible through the rear hatch (step ***p***). The fine levels (installed in step ***x***) are also observed through the rear hatch, and must be exactly centered. **A third fine level is placed on the level seat on the antenna yoke to be used as a final check of the leveling.**

* * * * *

■ 36. TRAINING.—It is extremely * * * the earliest opportunity. It is especially * * * of the set. Complete adjustment and maintenance procedures are covered in **TM 11–1327, 11–1427, and 11–1527.** The chief radar * * * "Equipment performance log."

■ 37. POWER PLANT.

a.

* * * * *

(6) (Added.) After the radio equipment is in full operation

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check the frequency meter to see that frequency does not vary from 60 cycles by more than about 0.5 cycle.

■ 38. CONVERTER.—If a commercial source of **220-volt, 3-phase, 25-cycle power** is to be used the converter must be used to change **it to 120-volt, single-phase, 60-cycle power.** A separate instruction * * * the steps follows:

* * * * *

■ 39. RADIO AND CONTROL EQUIPMENT.—This paragraph covers * * * SCR-545-A in operation. For initial operation after reaching a new position or details of the checks and adjustments necessary from time to time, see **TM 11-1327.**

a. Step 1. Close the MAIN CIRCUIT BREAKER on the power panel (fig. 44) in the trailer cab **and adjust the LINE VOLTAGE ADJUSTMENT (fig. 44) for 115 volts on the meter.**

Caution: **Before proceeding make sure the antenna is free and the doors of the air intake filter box are open.**

b. Step 2.—**Close the branch circuit breakers (fig. 44) in order, from left to right, top row then bottom row excepting the HEATER and SPARE breakers.** If the weather is extremely cold or damp, close the branch circuit breakers (fig. 44) marked HEATERS NO. 1, HEATERS NO. 2 **and the heater switch on the IFF equipment.** Also close the * * * in the TRACK TRANSMITTER. Allow the equipment to heat long enough **(normally about 15 minutes)** to dispel the dampness or bring the temperatures in the various unit up to the **proper operating temperature before turning on the high voltage. When the TRANS. FILAMENTS breaker is closed, the green pilot lamp at the top of the power panel should light. If the covers of all equipment are in place and the keyer motor is operating properly the amber lamp will come on in about 60 seconds indicating that the time delay is over and the equipment is ready for high voltage.**

c. Step 3 (Superseded).—With the HIGH VOLTAGE CONTROL on the HIGH VOLTAGE RECTIFIER (fig. 18) turned fully counterclockwise, press the HIGH VOLTAGE START

button on the power panel (fig. 44). The red pilot lamp should light indicating that the power is supplied to the HIGH VOLTAGE RECTIFIER. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). Then turn up the HIGH VOLTAGE CONTROL on the HIGH VOLTAGE RECTIFIER to get an output of 11.5 KV.

d. Step 4.—After the initial set-up, *Step 4* may be substituted for *Step 3* above if care is taken that the setting of the HIGH VOLTAGE CONTROL is not changed from its normal position as determined in *Step 3.* Press the HIGH VOLTAGE START button on the power panel (fig. 44). The red pilot lamp should light indicating that the equipment is in operation. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). **The meters on the HIGH VOLTAGE RECTIFIER should now read 11.5 kv and 75 ma. If the high voltage is not correct, adjust the HIGH VOLTAGE CONTROL to get correct value.**

* * * * *

g. Step 7.—The RANGE CONTROL UNIT * * * proper position (par. 12). **The switches in the DATA JUNCTION BOX (fig. 13) should be checked to see that they are properly set.**

* * * * *

n. Step 14.—Continuing with no signal in the range notch, set the TRACK GAIN CONTROL SELECTOR at **MANUAL** and **reduce** the GAIN CONTROL to **minimum.**

* * * * *

r. Step 18.—**With the TRACK GAIN CONTROL SELECTOR switch on AUTOMATIC, turn the TRACK AUTOMATIC GAIN CONTROL fully clockwise. Then** turn the TRACK AUTOMATIC GAIN CONTROL counterclockwise until the noise starts to decrease. Leave it at this point.

* * * * *

■ 40. SCOPE.—This section deals * * * line of sight. **For other consideration in connection with furnishing correct data see appendix VIII.**

button on the power panel (fig. 44). The red pilot lamp should light indicating that the power is supplied to the HIGH VOLTAGE RECTIFIER. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). Then turn up the HIGH VOLTAGE CONTROL on the HIGH VOLTAGE RECTIFIER to get an output of 11.5 KV.

d. Step 4.—After the initial set-up, *Step 4* may be substituted for *Step 3* above if care is taken that the setting of the HIGH VOLTAGE CONTROL is not changed from its normal position as determined in *Step 3.* Press the HIGH VOLTAGE START button on the power panel (fig. 44). The red pilot lamp should light indicating that the equipment is in operation. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). **The meters on the HIGH VOLTAGE RECTIFIER should now read 11.5 kv and 75 ma. If the high voltage is not correct, adjust the HIGH VOLTAGE CONTROL to get correct value.**

* * * * *

g. Step 7.—The RANGE CONTROL UNIT * * * proper position (par. 12). **The switches in the DATA JUNCTION BOX (fig. 13) should be checked to see that they are properly set.**

* * * * *

n. Step 14.—Continuing with no signal in the range notch, set the TRACK GAIN CONTROL SELECTOR at **MANUAL** and **reduce** the GAIN CONTROL to **minimum.**

* * * * *

r. Step 18.—**With the TRACK GAIN CONTROL SELECTOR switch on AUTOMATIC, turn the TRACK AUTOMATIC GAIN CONTROL fully clockwise. Then** turn the TRACK AUTOMATIC GAIN CONTROL counterclockwise until the noise starts to decrease. Leave it at this point.

* * * * *

■ 40. SCOPE.—This section deals * * * line of sight. **For other consideration in connection with furnishing correct data see appendix VIII.**

button on the power panel (fig. 44). The red pilot lamp should light indicating that the power is supplied to the HIGH VOLTAGE RECTIFIER. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). Then turn up the HIGH VOLTAGE CONTROL on the HIGH VOLTAGE RECTIFIER to get an output of 11.5 KV.

d. Step 4.—After the initial set-up, *Step 4* may be substituted for *Step 3* above if care is taken that the setting of the HIGH VOLTAGE CONTROL is not changed from its normal position as determined in *Step 3.* Press the HIGH VOLTAGE START button on the power panel (fig. 44). The red pilot lamp should light indicating that the equipment is in operation. The incoming voltage should now be adjusted to 115 volts by means of the LINE VOLTAGE ADJUSTMENT (fig. 44). **The meters on the HIGH VOLTAGE RECTIFIER should now read 11.5 kv and 75 ma. If the high voltage is not correct, adjust the HIGH VOLTAGE CONTROL to get correct value.**

* * * * *

g. Step 7.—The RANGE CONTROL UNIT * * * proper position (par. 12). **The switches in the DATA JUNCTION BOX (fig. 13) should be checked to see that they are properly set.**

* * * * *

n. Step 14.—Continuing with no signal in the range notch, set the TRACK GAIN CONTROL SELECTOR at **MANUAL** and **reduce** the GAIN CONTROL to **minimum.**

* * * * *

r. Step 18.—**With the TRACK GAIN CONTROL SELECTOR switch on AUTOMATIC, turn the TRACK AUTOMATIC GAIN CONTROL fully clockwise. Then** turn the TRACK AUTOMATIC GAIN CONTROL counterclockwise until the noise starts to decrease. Leave it at this point.

* * * * *

■ 40. SCOPE.—This section deals * * * line of sight. **For other consideration in connection with furnishing correct data see appendix VIII.**

■ ***41. Calibration of Range Dials*** (Superseded).—*a.* There is a fixed amount of time delay in the range notch (fig. 50) circuits and a different amount of time delay in the receiver circuits. Because of this difference there is always a certain amount of difference in readings between the range dials on the RANGE UNIT (fig. 24) and the range dials on the RANGE CONTROL UNIT (fig. 12) in the cab. This difference is called the "zero reference number" and should be recorded in the log book.

Note. The "zero reference number" and "operators dials check number", explained below, for the RANGE UNIT and TRACK RECEIVER installed in the trailer are determined by the manufacturer and entered in the log book furnished with the equipment.

b. Normal range calibration is accomplished as follows:

(1) Set the RANGE CONTROL UNIT to "Automatic" and "lock on" a good track signal from a fixed target whose range is accurately known.

(2) Subtract the known target range from the reading of the range dials on the RANGE UNIT. Record the difference in the log book as the "zero reference number" for that particular RANGE UNIT and TRACK RECEIVER combination.

(3) Using the RANGE HANDWHEEL, set the range dials on the RANGE UNIT to the "zero reference number."

(4) Then, without moving the RANGE HANDWHEEL, loosen and set the range dials on the RANGE CONTROL UNIT to read zero range.

c. Since a fixed target at known range is not always available for checking range calibration, it is desirable to have some means of checking range calibration without a target. This may be done by making use of the "operator's dial check number" which is recorded in the log book. The "operator's dial check number" should be determined whenever range calibration on a known range target is performed and recorded in the log book for future use. It may be determined as follows:

(1) Complete range calibration using a fixed target at known range.

(2) Reduce TRACK RECEIVER gain until the "main pulse" in the TRACK RANGE SCOPE is just under saturation.

(3) Using the RANGE HANDWHEEL carefully align the

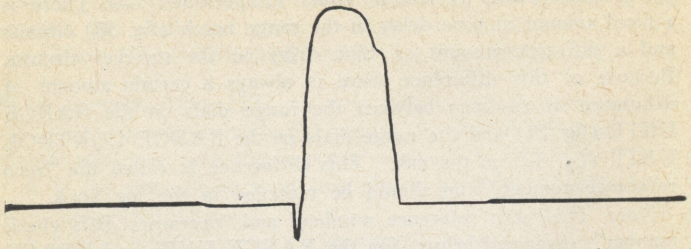


FIGURE 44.1—Alignment of "main pulse" and range notch.

left side of the "main pulse" with the left side of the range notch so that the left spike formed below the baseline is one-half the height of the notch (fig. 44.1).

(4) Record the reading of the range dials on the RANGE CONTROL UNIT in the log book as the "operator's dial check number" (for that particular RANGE UNIT and TRACK RECEIVER combination).

d. To check range calibration using the "operator's dial check number", the following procedure is used:

(1) Set the range dials on the RANGE UNIT to the "zero reference number" (latest recorded in the log book) by positioning the RANGE HANDWHEEL.

(2) The RANGE CONTROL UNIT dials should now read zero range.

(3) Carefully align the range notch and "main pulse" as in paragraphs 41c (2) and (3).

(4) The range read on the RANGE CONTROL UNIT dials should equal the "operator's dial check number" (latest recorded in the log book) within ± 10 yards if range calibration is correct.

(5) If the difference is greater than ± 10 yards a new "zero reference number" should be determined by completing range calibration using a fixed, known range target.

(6) A new "zero reference number" may be determined by correcting the old "zero reference number" by the amount of change in "operator's dial check number" if a fixed, known range target is not available.

■ 42. CALIBRATION OF RANGE, ANGULAR HEIGHT, AND AZIMUTH POTENTIOMETERS (Superseded).—The range and angular height potentiometers are part of the data transmission system when the SCR–545–A is used with the M9 (or M10) director and part of the calculating system of the RANGE CONVERTER when used with the M4 or M7 director. These potentiometers will seldom require adjustment in the field. The azimuth potentiometer is a part of the data transmission system used with the M9 (or M10) director.

a. Slant range potentiometer.—The range potentiometer will normally *require adjustment only if a change in "zero" reference number" is indicated. The new "zero" reference number is set on the RANGE UNIT dials, and the range potentiometer is reset (calibrated) by the procedure outlined in TM 11–1527.*

b. Angular height potentiometer.—When there is reason for doubting the alignment (calibration) of the potentiometer zero with zero elevation angle of the TRACK beam, it may be reset or checked. Refer to log book entry reading "adjust elevation potentiometer to minimum resistance when elevation dial on antenna mount reads—mils" and set the antenna for that dial reading or to zero if there is no such entry in the log book. Then set the elevation potentiometer as outlined in TM 11–1527.

c. Azimuth potentiometer.—The azimuth potentiometer must be adjusted each time the trailer location is changed. Its calibration is automatic when synchronizing with the M9 director.

■ 43. CALIBRATION IN ALTITUDE (HEIGHT).—When using the * * * the following procedure:

a. **Set the DATA SELECTOR SWITCH in the DATA JUNCTION BOX to the M4, M7, T20 position and the DATA FLOW SWITCH on the RANGE CONTROL UNIT to ALT.**

b. Operate the RANGE * * * the RANGING EQUIPMENT.

c. Operate the ELEVATION * * * in figure 45.

d. The ALTITUDE DIAL on the RANGE CONVERTER **(fig. 45)** should now read 7,500 yards. If there is any variation * * *.

e. Check the altitude * * * in the cab.

f. If the calculations are not correct (**within ± yards**) for all altitudes the frequency of the RANGE CONVERTER should be checked by the procedure outlined in **TM 11–1527.**

■ 44. ORIENTATION AND SYNCHRONIZATION IN AZIMUTH.—*a. Directors M4, M7, T20.*

* * * * *

(4) Using the wrenches * * * of the director. **Then tighten the clamping rings of the transmitters, being careful not to change their settings.**

* * * * *

(7) Traverse the director * * * indicate identical readings. Set the upper and lower dials of the AZIMUTH TARGET DESIGNATION (fig. 16) unit to coincide at this same reading **by means of the screw driver adjustments on the unit.**

b. Director M9.—(It is assumed here that the cabling recommended in paragraph 27**c** or ***d*** is being used.)

* * * * *

(2) Set the DATA * * * SWITCH at REMOTE. The DATA FLOW SWITCH (fig. 12) on the RANGE CONTROL UNIT **may be in either position.**

NOTE: **The DATA FLOW SWITCH must be in the M9 ON position when the computer of the director M9 or M10 is being "zero set". The toggle switch on the base of the tracker may be in either the HF or RAD position.**

* * * * *

(4) Loosen and rotate * * * of the director. **Then tighten the clamping rings of the transmitters, being careful not to change their settings.**

* * * * *

(8) Leave the antenna of the SCR–545–A at the position set in step (7). Set **the test switch on** the computer of the director for TRACKER TEST.

NOTE: **All corrections for wind, parallax, and spots, on the computer should be set at zero for this step in the procedure.**

Loosen **THE AZIMUTH POTENTIOMETER LOCK** and operate the **AZIMUTH POTENTIOMETER CRANK** (fig. 47) on the SCR–545–A until the azimuth indicated on the **firing azimuth dials of the** computer agrees with the azimuth setting of the antenna as set in step (7).

c. Director M9.—If the tracker * * * (1) (*b* above).

(2) Set the DATA SELECTOR SWITCH on the DATA JUNCTION BOX (fig. 31) at M9 and the TOGGLE SWITCH at LOCAL. The DATA FLOW SWITCH on the RANGE CONTROL UNIT **may be in either position.**

Note. **The DATA FLOW SWITCH must be in the M9, ON position when the computer of the director M9 or M10 is being "zero set".**

* * * * *

■ 45. ORIENTATION AND SYNCHRONIZATION IN ELEVATION (ANGULAR HEIGHT).—*a. Directors M4, M7, T20.*—(1) Check the level of the mount carefully.

(2) **Refer to log book entry reading "adjust elevation data synchros for zero elevation when elevation dial reads—mils" and set the antenna for that dial reading** by means of the ELEVATION HANDWHEEL on the ELEVATION CONTROL UNIT (fig. 14) in the cab. **If there is no such entry in the log book, set the antenna for a dial reading of zero mils.**

* * * * *

(4) **Remove the metal cover and** loosen **the clamping rings of** the coarse and fine synchronous transmitters on the pedestal trunnion nearest the seat on the pedestal (fig. 48). Rotate the transmitters until the dials on the director indicate **zero mils. Then tighten the clamping rings of the transmitters, being careful not to change their settings.**

(5) Check, and if necessary reset the dials on the ELEVATION (angular height) CONTROL UNIT (fig. 14) to **read zero mils.**

(6) Adjust the ELEVATION * * * (fig. 9) as follows:

(a) By means of the screw driver adjustment, rotate the upper synchronous receiver housing to make the upper dial read the same as the **angular height of the director telescopes** on any one of its three sectors.

(b) By similar means set **a reading of zero mils** on the lower dial.

b. Director M9.—This subparagraph covers elevation orienta-

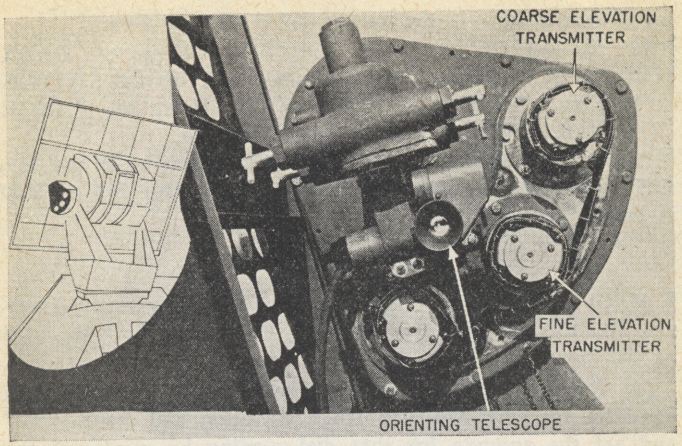


FIGURE 48.—Angular height synchronous transmitters and orienting telescope.

tion and synchronization for the cabling set-up recommended in paragraph 27*c* or ***d***.

* * * * *

(3) Set the TOGGLE * * * or RAD position.

* * * * *

(7) With the **test switch of the** computer of the director set for TRACKER TEST, the reading on the QUADRANT ELEVATION dial at the computer should agree with the reading on the angular height scale (fig. 45) on the antenna trunnion.

NOTE: **All corrections for wind, parallax, and spots should be set at zero for this step in the procedure.**

If the readings do not agree, refer to TM **11–1527** for adjustment procedure on the elevation potentiometer **and adjust the potentiometer to make the readings agree.**

* * * * *

■ 47. SYNCHRONIZATION IN SLANT RANGE.—*a.* Range calibration as discussed in paragraph 41 **and range potentiometer calibration as discussed in paragraph 42, are** assumed to be completed. Synchronization with director * * * the RANGING EQUIPMENT.

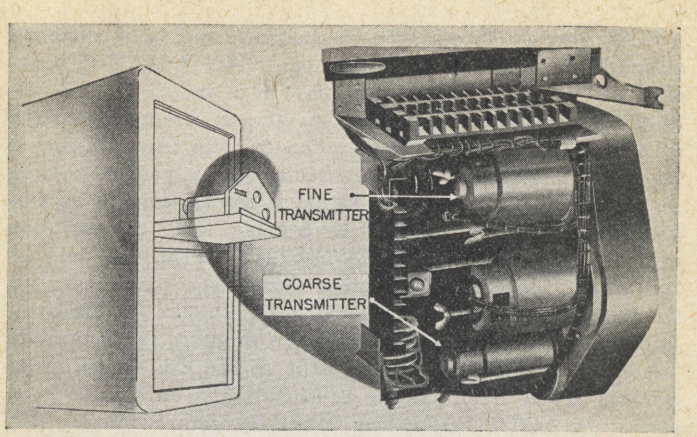


FIGURE 49.—Range unit shelf of ranging equipment.

c. Rescinded.

■ 48. OPERATION.—Following is a * * * with the SCR-545-A:

a. The equipment is * * * controls as follows:

* * * * *

ELEVATION CONTROL
UNIT:
AID SWITCH ..... **OFF**

* * * * *

b. The elevation operator sets the antenna for an angular height of **100** mils.

c. The azimuth operator **turns the** AZIMUTH HANDWHEEL **three or four turns in a clockwise direction, starting from zero rate. This causes the antenna to traverse at a moderate rate.**

* * * * *

e. When an echo appears on the scopes, the azimuth operator stops the rotation of the antenna by **rapidly turning the** AZIMUTH HANDWHEEL **three or four turns counterclockwise. He then switches to AID OFF.** The range operator * * * than 200 mils. **Therefore, the elevation operator in attempting to match echo heights should take care not to depress below zero mils elevation.**

f. As soon as the echo gets in the notch **and is of sufficient strength** the range operator switches to AUTOMATIC, **if desired.** The azimuth operator may also switch to AUTOMATIC **at this time** since he has already been keeping the echo heights matched. The elevation operator may still find it impossible to match echo heights, but as soon as possible he does so. **When the track system signal is strong enough as evidenced by the AUTO FADE lamp being "out," the elevation operator may switch to AUTOMATIC. When the radar is "on target" on TRACK system signals** the range operator should operate the DATA FLOW SWITCH to the "On" position **(when using the director M9 or M10) or press down the ON TARGET foot switch on the floor of the cab (when using director M4 or M7).** If the echo is strong on the TRACK scopes, the AUTO FADE lamp should be dark, signifying that the SCR–545–A is tracking the target from TRACK system signals. If the **TRACK system** signal should fade and the AUTO FADE lamp light it is necessary for the elevation operator to track manually until the light goes out again **because the SCR–545–A tracks automatically on SEARCH system signals *only in range and azimuth.*** Figure 52 shows a target properly positioned in the notch of the TRACK system, with the azimuth and elevation scope pictures matched in echo heights. **As the target changes range the setting of the AUTOMATIC GAIN CONTROL on the TRACK RECEIVER CONTROL unit should be readjusted as required to keep the echo approximately ¾ saturation height.**

g. **The AID SWITCHES on all OPERATOR'S CONTROL UNITS should be set to ON after automatic tracking is established. This will facilitate switching from automatic tracking to aided manual tracking in case this becomes necessary because of interfering aircraft or fixed echoes.**

h. With an echo such as * * * on the AUTOMATIC system.

i. (Added.) Aided manual tracking results in better data than automatic tracking under some conditions. Some of these conditions are when the AUTOMATIC CONTROLLER will not function properly, when the target echo is intermittently or partially obscured by fixed echoes, when the target is part of a massed

formation, and in the presence of enemy jamming. The azimuth and elevation operators set their respective OPERATOR'S CONTROL UNITS for aided manual tracking and adjust the AZIMUTH HANDWHEEL and ELEVATION HANDWHEEL to keep the target echo heights matched. The range operator sets his OPERATOR'S CONTROL UNIT for aided manual tracking and adjusts the RANGE HANDWHEEL to keep the target echo centered in the range notch. All operators should be proficient in this method of tracking.

APPENDIX III

GLOSSARY OF TERMS

* * * * *

Notch.—A depression in the base line on the oscilloscope screens, used in tracking targets **in range.**

* * * * *

Search.—In the SCR–545–A the SEARCH system is used to detect the approach of planes at medium ranges **and to put the TRACK system on target.**

* * * * *

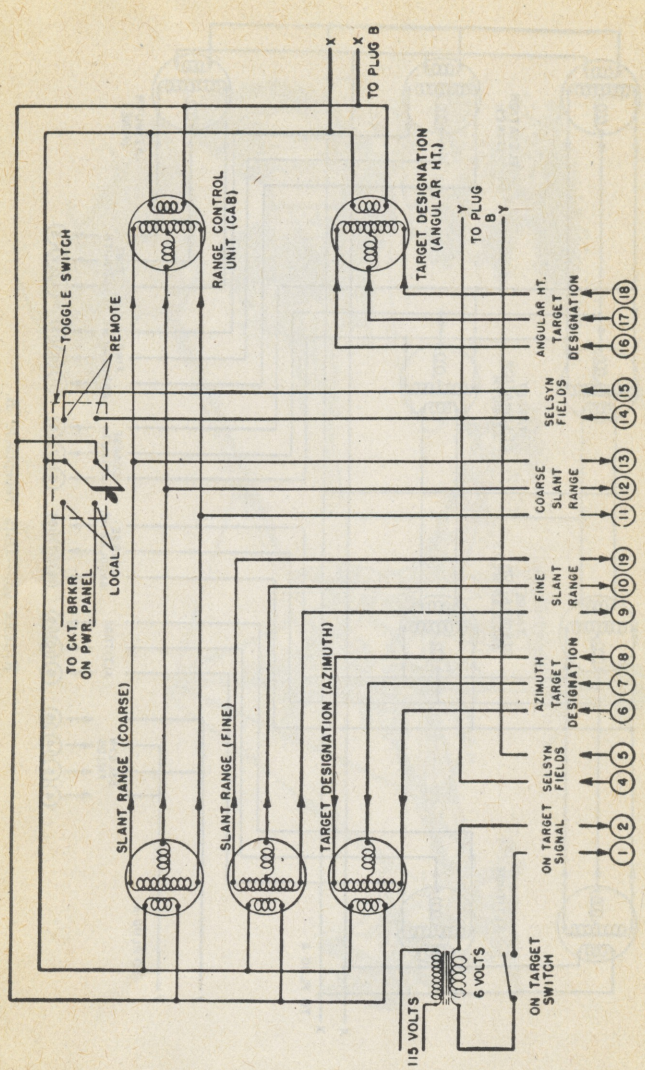


FIGURE 62.—Data receptacle A.

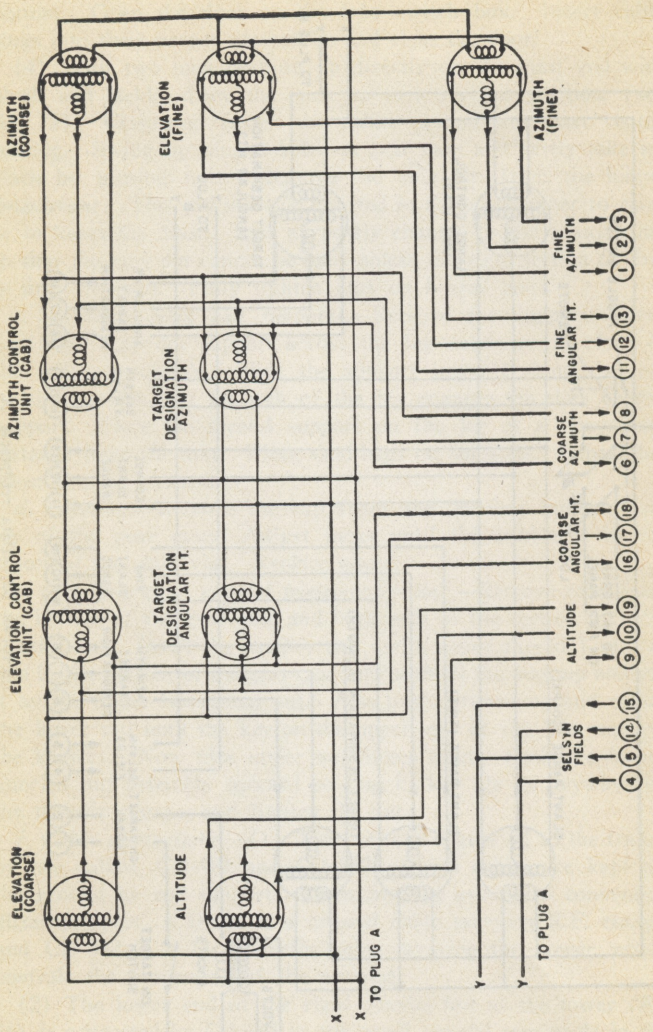


FIGURE 63.—Data receptacle B.

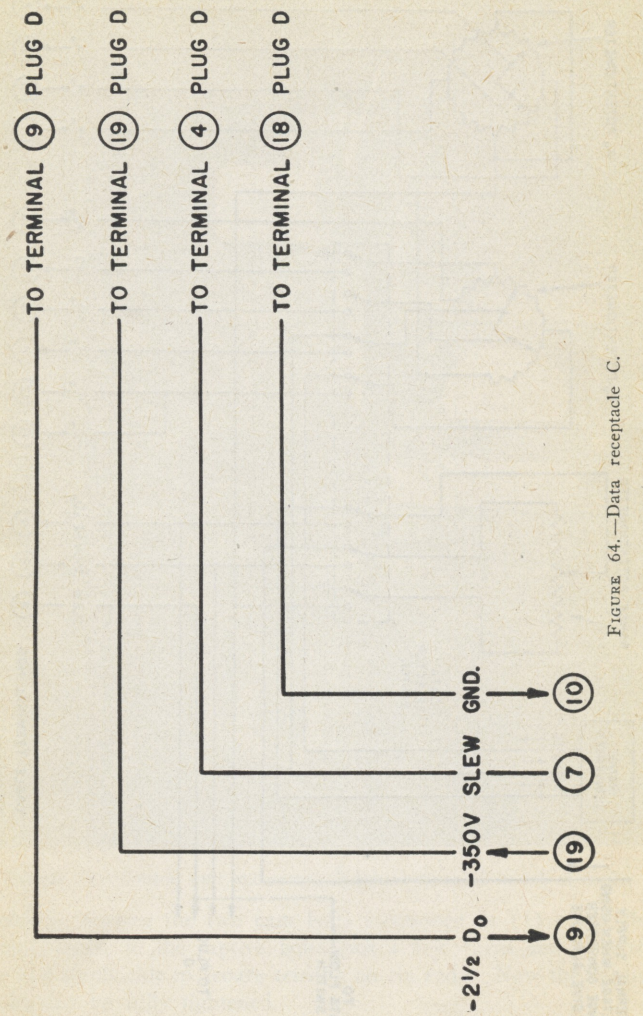


FIGURE 64.—Data receptacle C.

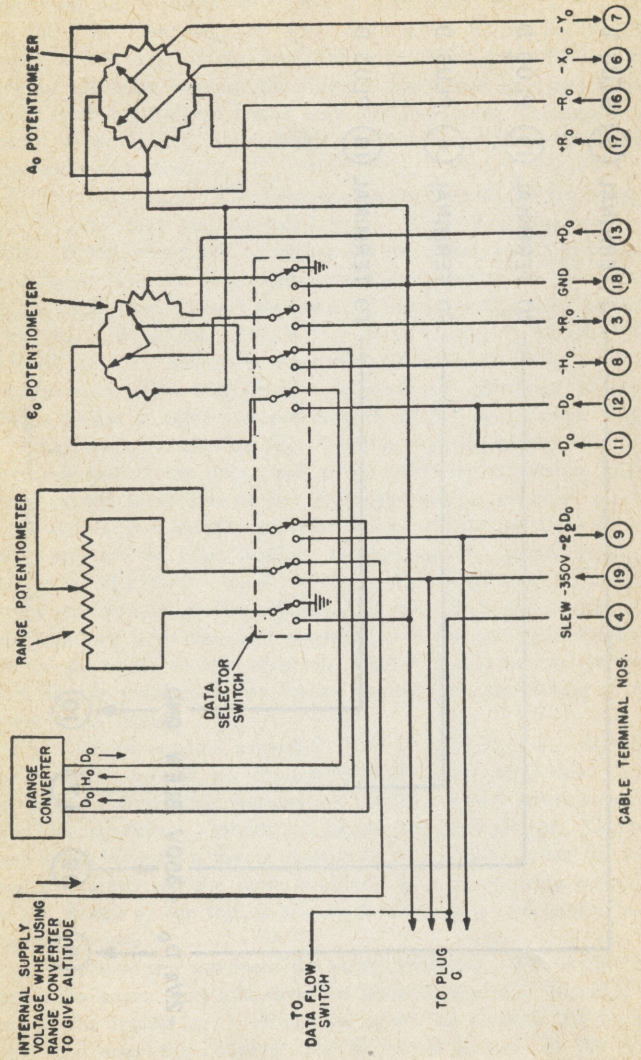


FIGURE 65.—Data receptacle D.

APPENDIX VII (added)

TRIAL FIRE SPOTTING WITH SCR–545–A

1. Trial Fire deviations can be obtained by use of the SCR–545–A with a reasonable amount of accuracy. The following operations are necessary to prepare the set for spotting. (For principles of radar spotting see TF 4–1363, Radar Spotting of Trial Fire.)

a. After careful alignment of the optical and electrical axes (Collimation of the telescope), orientation, synchronization, and range calibration, the SCR–545–A is positioned on the T S P in azimuth, elevation, and slant range by means of the respective OPERATOR CONTROL UNIT handwheels.

b. Adjust the sweep of the TRACK range scope to maximum expansion by means of the SWEEP EXPANSION control. Do not change this setting during the rest of the procedure.

c. Set the GAIN CONTROL SELECTOR switch on the TRACK RECEIVER CONTROL UNIT to MANUAL. Adjust the MANUAL GAIN CONTROL so that noise on the range scope is approximately 25 percent of the main pulse height.

d. Remove the cover plate from the range scope and place an auxiliary scale on the face of the TRACK range scope approxi-

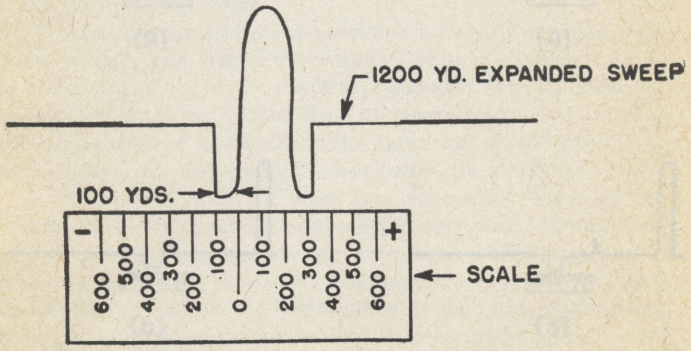


FIGURE 66.—Relation of auxiliary scale and range notch.

mately at the range of the T S P. The scale is made and calibrated in the following manner:

(1) A pair of dividers is used to pick off the length of the "1200-yard expanded sweep" and lay off that length on a small piece of paper to be used as a scale.

(2) That length is divided into equal 100-yard deviations, with the center of the scale "0" (fig. 66). The values are increasing (+) on the right side and decreasing (—) on the left side. If the auxiliary scale is calibrated at average range (of T S P's), the same scale may be used throughout the range of the T S P's with no appreciable loss of accuracy.

e. It will be necessary to move and recenter the scale on the new slant range whenever a new T S P is selected. The correct relation of the scale "0" to the range notch may be found by "locking on" a fixed echo by setting the RANGE CONTROL UNIT to AUTOMATIC and noting the number of yards between the left edge of the range notch and the left edge of the echo as indicated in figure 66. For this example the scale "0" should be placed 100 yards to the right of the range notch left edge.

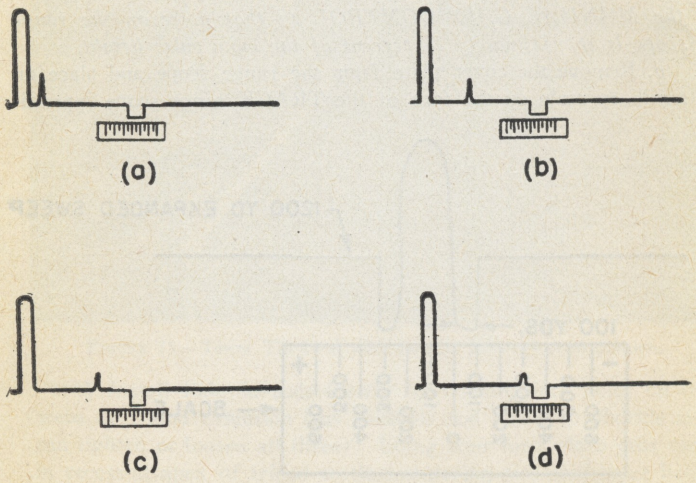
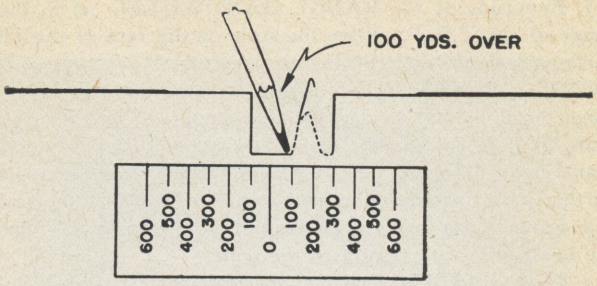
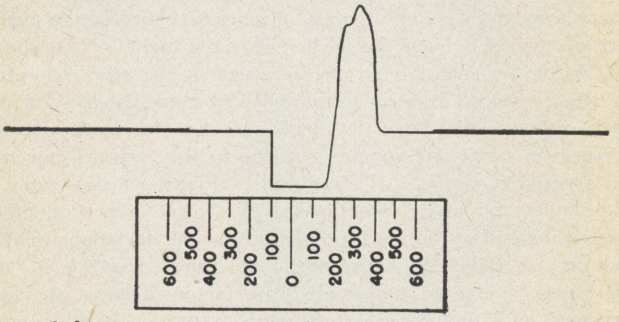


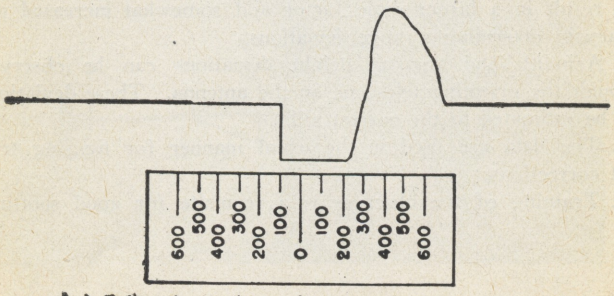
FIGURE 67.—Echo from shell during flight.



(a) Echo at instant of burst



(b) Echo immediately after burst



(c) Echo short time after burst

FIGURE 68.—Appearance of burst echo at different times.

f. By means of the RANGE HANDWHEEL set in the slant range of the T S P. Place the scale on the face of the TRACK range scope tube underneath the range notch, and adjust HORIZONTAL POSITIONING control so that the left edge of the range notch is 100 yards (for this example) to the left of the scale "0". If comparison with bilateral spotting indicates a constant error in range deviation, a correction can be applied by further adjusting the range notch with reference to the scale "0".

2. Range deviations can be determined by noting the relation of the burst echo with respect to the scale.

a. If the T S P is such that the trajectory of the shell lies in the TRACK beam, portions of the flight of the shell may be observed on the TRACK scopes. Figure 67 indicates the appearance of the echo from the shell during the flight of the shell.

b. At the instant of burst the left edge of the weak echo from the shell seems to leap up to be followed immediately by a relatively strong echo from the burst. After the burst the echo increases in range and spreads out due to the forward movement and spreading of the shell fragments. Figure 68 illustrates the echo under the above conditions. The lower left edge of the burst is marked at the instant of burst and the deviations in yards read on the scale. In figure 68(a) the range deviation is "over 100 yards." Due to the small scale factor, a burst should be estimated only to the nearest 50 yards.

c. It may be expected that any modification to the range TRACK scope that provides increased expansion of the sweep will result in a larger scale factor and somewhat increased accuracy in determining range deviations.

3. Azimuth and angular height deviations can be observed through the orienting telescope on the antenna. These deviations can be estimated to the nearest mil.

4. The data are used in the usual manner for figuring trial shot corrections.

5. Training of the observer is a requisite for good spotting.

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APPENDIX VIII (added)

OPTICAL, ELECTRICAL, AND MECHANICAL ALIGNMENT

■ 1. GENERAL.—The purpose of this section is to explain the use of the orienting telescope (fig. 48) and principles of alignment that must be followed in order to determine and transmit the correct present position data of a target. Range calibration has been covered in paragraph 41. This discussion covers those points necessary for determining and transmitting correct azimuth and angular height data.

a. Orienting telescope.—The orienting telescope is used in orienting the SCR–545–A in azimuth by sighting on a point or object of known azimuth. The relation of the telescope line of sight with the mechanical angular height scales on the antenna (fig. 45) must be correct for orienting and synchronizing in angular height. Therefore, the line of sight of the telescope must be parallel with the electrical axis of the TRACK beam.

b. Electrical and mechanical axes.—The TRACK beam axis must be perpendicular to the mechanical axis of elevation in order that correct azimuth data may be transmitted to the director at all angular heights. The TRACK beam axis position in angular height must be indicated correctly on the mechanical angular height scales on the antenna.

c. Precautions.—Checks should be made periodically that the telescope line of sight is parallel to the TRACK beam axis and that the *TRACK beam axis is properly related to the mechanical axis.*

■ 2. ORIENTING TELESCOPE AND ANGULAR HEIGHT SCALES.—The vernier scales of the telescope (fig. 48) and the mechanical angular height scales on the antenna (fig. 45) must be read with care.

a. At the factory the orienting telescope and its scales are adjusted so that both the azimuth and angular height verniers read "zero-zero" when the line of sight of the telescope is parallel to the TRACK beam axis. When it is found necessary to adjust the telescope, the change in position as indicated on the vernier

scales must be carefully noted and recorded. The azimuth and angular height vernier scales are identical; so the angular height scale only will be explained. The movable part of the scale is attached to the telescope and each division is equal to 20 mils. The stationary part of the scale is attached to the telescope mounting and is a vernier for the movable scale so that increments of one (1) mil can be read (fig. 69a). The following examples explain the use of the vernier scales:

(1) When the zero of the movable scale is above the zero of the fixed vernier scale, the telescope is pointing below zero or tilted downward. In figure 69b the telescope is pointing below zero or tilted downward by 16 mils.

(2) When the zero of the movable scale is below the zero of the fixed vernier scale, the telescope is pointing above zero or tilted upward. In figure 69c the telescope is pointing above zero or tilted upward by 37 mils.

b. The mechanical angular height scales (fig. 45) on the antenna should indicate the angular (elevation) position of the TRACK beam axis. The dial has one scale that reads in hundreds of mils and one scale that reads in mils (fig. 70).

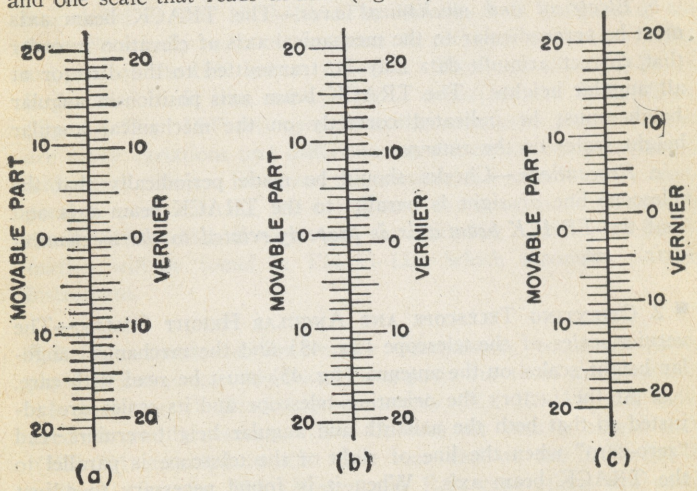

FIGURE 69.—Orienting telescope scales (angular height).

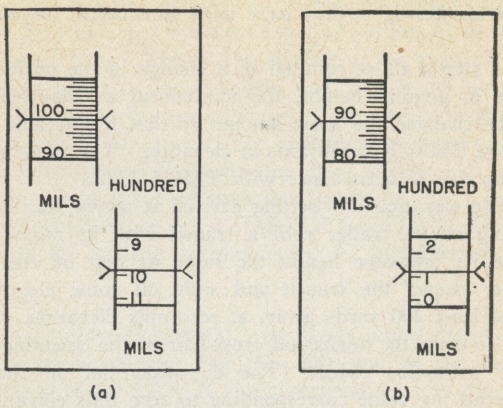

FIGURE 70.—Mechanical angular height scale.

(1) For angles above zero mils, the scales are read direct. Figure 70a shows a reading of 998 mils.

(2) For angles below zero mils, the fine scale reads backwards and the correct value is obtained by subtracting the MIL scale reading from 100 and adding the result to the HUNDRED MIL scale reading. Figure 70b shows a reading of —112 mils.

■ 3. ALIGNMENT OF OPTICAL AND ELECTRICAL AXES.—Before orienting and synchronizing, optical and electrical axes alignment should be checked and certain adjustments made. A description of these follows:

a. Check of alignment.—With the radar in normal operation, track "automatically" a meteorological balloon carrying a corner reflector, or a plane whose angular height is greater than 200 mils. The target should be bisected by the vertical and horizontal cross hairs in the orienting telescope. If the target is a plane, several courses should be tracked, if possible, to determine the average deviation. The telescope should be adjusted by the radar repairman as prescribed in TM 11-1527, until alignment is obtained. The position of the *telescope as indicated on its scales both before and after adjustment should be recorded in the log book.*

b. Correlation of optical axis with mechanical angular height scale.—

(1) If step *a* above resulted in a change in the position of the telescope in angular height, the mechanical angular height scale should be changed the same amount so that it indicates the position of the TRACK beam axis in elevation. The radar repairman should do this in accordance with TM 11–1527.

(2) The elevation dial setting arrived at above may be checked by placing on the trailer roof a transit with its tripod adjusted to make its telescope height the same as that of the orienting telescope. Level the transit and sight on some clearly defined object at least 400 yards away, at zero mils elevation. Train the antenna to make the horizontal cross hair of the orienting telescope coincide with this object. The elevation dial on the antenna should read the value corresponding to zero mils elevation of the antenna (TRACK beam) as noted in the log book. If there is no such notation in the log book, the dial should read zero.

(3) The elevation dial setting may also be checked with a reasonable degree of accuracy by back sighting the radar on a director and noting that the angle of elevation of the director is equal to the angle of depression of the antenna.

c. Data system adjustment.—After changing the position of the orienting telescope it will be necessary to reorient and resynchronize the azimuth and elevation data systems.

(1) *Elevation data.*—The mechanical angular height dial is adjusted as in *b*(1) above and the following steps performed:

(a) Refer to log book entry "elevation dial reading when the elevation data synchros are synchronized at zero elevation". Set the antenna at that elevation and synchronize the elevation synchros.

(b) Refer to log book entry "elevation dial reading when the elevation potentiometer is adjusted to minimum resistance". Set at that elevation and adjust the elevation potentiometer (done by radar repairman).

(c) Refer to log book entry "elevation dial reading when TRACK antenna beam is horizontal". Set the antenna at that elevation (as indicated on mechanical angular height scales) and set the dials on the ELEVATION CONTROL UNIT to read zero.

(d) If there are no such entries in the log book as mentioned above, use zero mils for the elevation dial setting in each case.

(2) *Azimuth data.*—Record the reading of the azimuth scale of the orienting telescope and calculate and record the amount the telescope line of sight now deviates from perpendicular to the mechanical axis of elevation. The antenna is sighted on a point of known azimuth and the following steps taken:

(a) Resynchronize the azimuth data synchros.

(b) Reset the dials on the AZIMUTH CONTROL UNIT.

(c) Reset the azimuth potentiometer (if M9 director is being used).

■ 4. ALIGNMENT OF ELECTRICAL AND MECHANICAL AXES.—*a.* The TRACK antenna reflector has been adjusted at the factory to make the axes of the TRACK beam perpendicular to the mechanical axes of elevation. If this is not true, a variable error is transmitted azimuth data, depending on the angular height will result. This may be explained by assuming that the TRACK beam is 5 mils off perpendicular to the mechanical axes of elevation and the azimuth data transmission system which is mechanically positioned by the antenna is synchronized using a point at 0 mils elevation. Then if the radar tracks a target having a constant azimuth from 0 mils to 800 mils angular height, the antenna must traverse 2.07 mils in order for the TRACK beam to stay on target. Thus a change in azimuth of 2.07 mils is transmitted to the director although the azimuth of the target does not change.

b. It is expected that the TRACK reflector will seldom require adjustment except after repairs on the antenna. A check procedure follows:

(1) After aligning the telescope and electrical axis (par. 3*a*) the amount the telescope line of sight deviates from perpendicular to the mechanical axis of elevation is determined (par. 3*c*(2)). This represents the approximate amount the electrical axis is off from perpendicular to the mechanical axis.

(2) If the amount is appreciable, the radar repairman should check and adjust the alignment of the TRACK reflector in accordance with procedure in TM 11-1527.

(3) Realignment of the optical and electrical axes should follow any adjustment to the TRACK antenna system.

APPENDIX IX (added)

CHARACTERISTICS OF SCR-545

TYPE		SCR-545
Purpose		Gun Laying
Operating Personnel		9
Transportation Dimensions:		
Type	Trailer	Prime Mover
Weight (tons)	14	14
Height	10′ 8″	12′ 10″
Width	8′	7′ 10″
Length	27′*	24′
Automotive Components	K-75-A Trailer Mount K-56-A Prime Mover K-60-B Work Truck	
Selsyn Data Transmitted:		
A_o (mils)	0 to 6400	
E_o (mils)	—200 to +1600 (approx.)	
D_o (yds)	300 to 10,000	
H_o (yds)	300 to 10,000	
Potentiometer Data Transmitted:		
D_o (yds)	0 to 28,000	
H_o (yds)	—5400 (approx.) to 28,000	
X_o (yds)	0 to 28,000	
Y_o (yds)	0 to 28,000	
Selsyn Data Received:		
A_o (mils)	0 to 6400	
E_o (mils)	—175 to 1600	
Normal Time Requirements for Handling:		
Emplacement	15 min.	
Movement from Emplacement	15 min.	
Orient & Synchronize	15 min.	

Radius of Flat & Level Space Needed for Emplacement	Not Essential
Slope Limitations of Terrain for Emplacement	±10°
Power:	
Source	Individual
Type of Power Plant	PE-145-A
Fuel Consumption (gal/hr)	3.5 to 4
Commercial Power Required if Used:	
Voltage	120
Phase	1
Frequency	50 or 60 c.p.s.
KVA**	15

* Includes 6′ drawbar.
** Includes power requirements of IFF equipment.

APPENDIX X (added)

SERVICE OF RADIO EQUIPMENT RC–145–A

SECTION I

GENERAL

■ 1. FUNCTION.—Radar sets cannot distinguish between hostile and friendly aircraft. The ranges at which radars detect aircraft are generally so great that visual recognition is impossible. In many cases the target is never seen because of overcast or lack of illumination. The RC–145–A is a radio set which operates in conjunction with the transponder of airborne equipment installed in United Nation's aircraft. The method of identification or recognition currently in use is known as the IFF system, Mk. III. It sends a challenge (pulse) toward an aircraft already spotted by radar. In the case of a friendly aircraft, the pulse causes the airborne equipment to function returning a coded answer which appears on the RC–145–A oscilloscope. (The code is included in TM 11–1531.) The RC–145–A is designed to operate electrically with transponders in airborne equipment which are part of the IFF system Mk. III. Physically the RC–145–A is designed to fit into and operate as a part of the SCR–545–A. (See fig. 71.) IFF sets operate on the same principles, but there are many variations and differences in the actual equipment used with other radars. However, the antenna and several entire components used with the RC–145–A are the same as those used in the RC–184, which is used with the SCR–584. Additional information will be found in TM 11–1331 which accompanies each instrument.

■ 2. DESCRIPTION.—*a.* Ten major components occur in three physical groupings. Interconnecting parts for them are provided.

b. Indicator (I–221–A), power supply (RA–105–A), and radio receiver and transmitter (BC–1267–A) fit into a single rack (FM–79) mounted in the right rear end of the SCR–545–A trailer. (See fig. 72.) Power and R.F. connections are automatically made when these components are pushed into the rack.

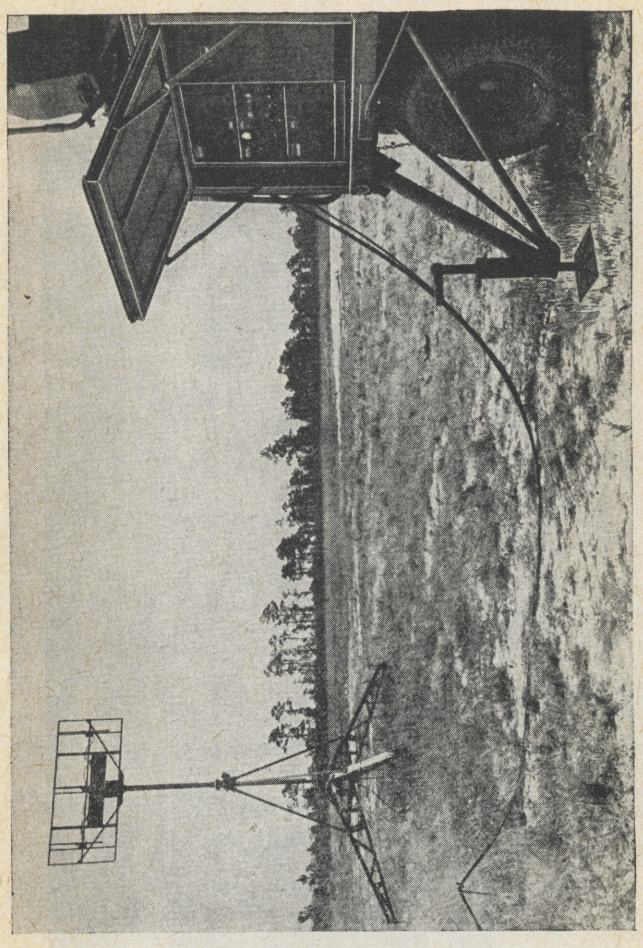

FIGURE 71.—RC–145 set up ready for operation.

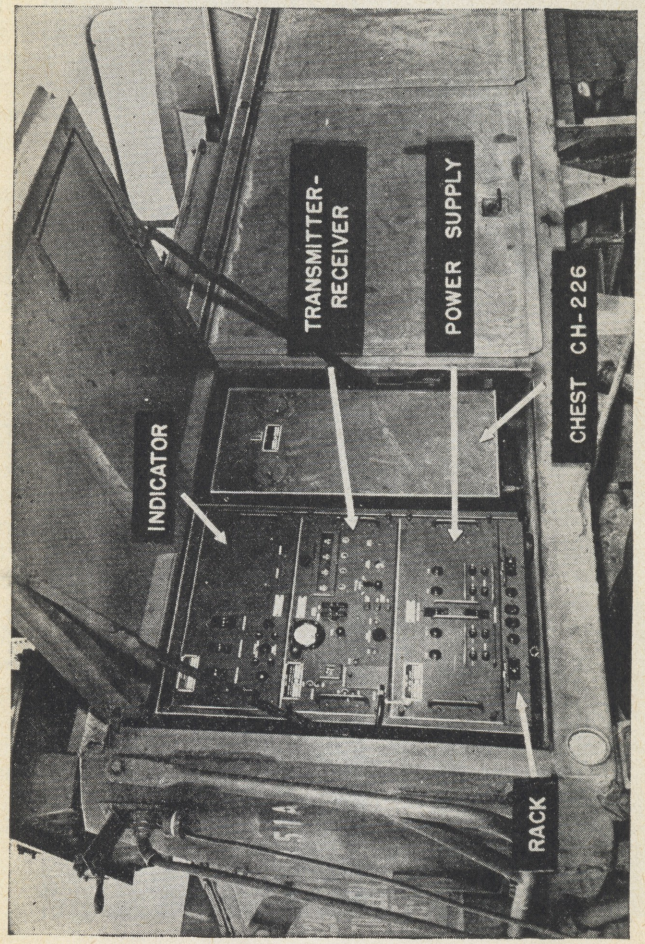

FIGURE 72.—Rack FM-79 and chest CH-226 installed in the SCR-545.

c. Tower (TR–24–A), switch (SW–220–A), and antenna (AN–154–A) (fig. 73) can be assembled by four men in about 20 minutes to form an antenna system rotatable on its mount assembly. It can be located up to 60 feet from the SCR–545–A. In traveling position, the tower, switch, and antenna are carried in a 1 ton trailer provided for this purpose.

d. The control unit (BC–1266–A) and remote indicator (I–227–A) are mounted in the cab of the SCR–545–A to the left of the range indicators. (See fig. 74.) A signal generator (I–222–A) is supplied and is stowed in chest CH–226 on the SCR–545 trailer.

SECTION II
EMPLACEMENT

■ 3. GENERAL.—Additional information is available in TM 11–1131 for the original installation and electrical connection of these components which are normally carried in the trailer. The general area of the site is selected to suit radar operation. Then the IFF antenna system is set up at full cable length (60 feet) from the radar mount and with the tripod on ground approximately of the same level as that where the radar is emplaced.

■ 4. ANTENNA.—*a. Tripod assembly.* (1) Select the one tripod leg with a collar at its large end. Hold it with the collar down about a foot above the ground. Hook the other two tripod legs to cam bolts on this collar.

(2) Select the three identical extension legs, turn the hexagonal heads of their cam bolts full clockwise without forcing. Raise the lower end of one of the tripod legs and also raise an extension leg with its outer end higher than its inner end so that its cam bolt can be inserted in the slot in the upper web of the tripod leg. Insert captive pin and secure it with cotter pin attached.

(3) Repeat (2) with the other two extensions. Then tighten all three cam bolts counterclockwise until upper webs butt together.

(4) Straddle the end of a leg extension. Lift it up, at the same time drawing a jack screw and foot plate into position, until the forked slots fit over the brass collars of the jack. Still lifting, turn the catch counterclockwise until it locks in the slot.

(5) Repeat (4) for the other two jacks.

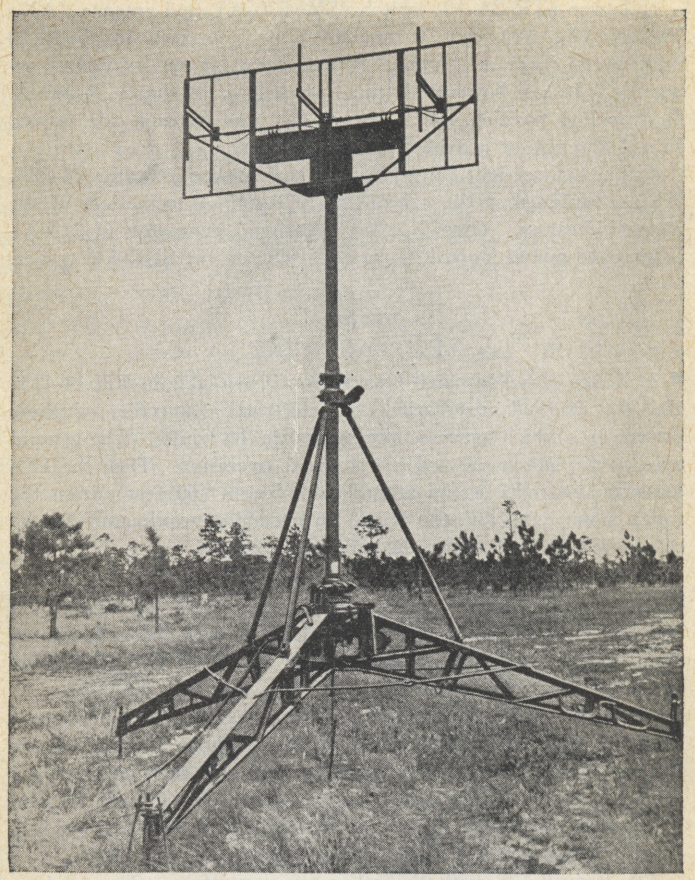

FIGURE 73.—Tower TR–24–A with antenna AN–154–A in position.

(6) Install link tie rods loosely by hooking into holes on top webs of tripod extension legs (one tie rod has a turnbuckle and can tighten or loosen all three). Using four men, place gear case in recess at apex of tripod so that centering pins will enter holes in gear case. (It probably will be necessary to align the pins and

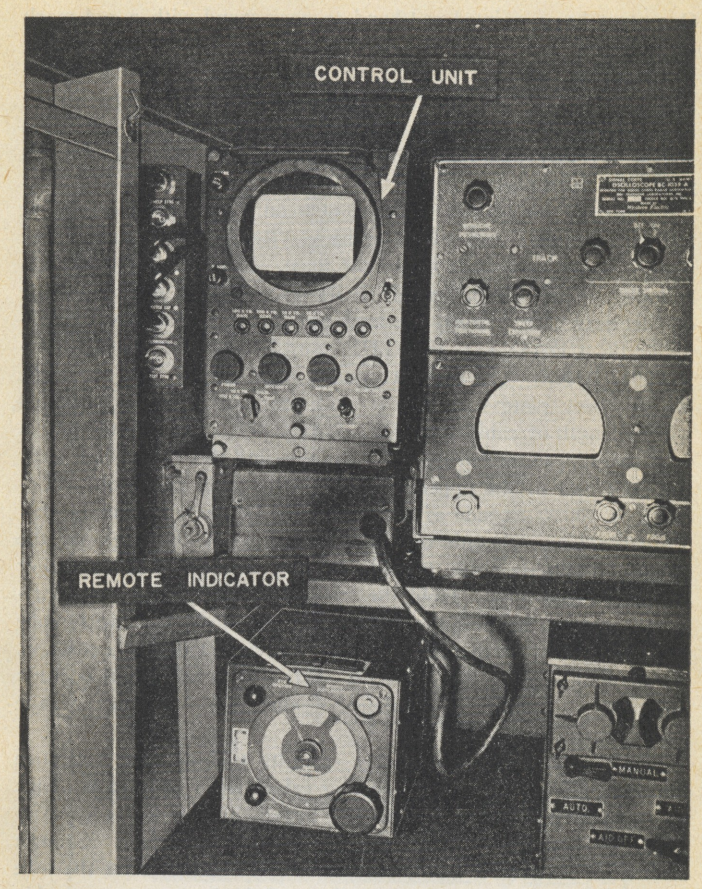

FIGURE 74.—Control unit and remote indicator mounted in cab of trailer.

holes by moving the two cam bolts mentioned in (1).) At this point, screw in the captive bolts just a few turns and turn the tie-rod turnbuckle to secure tension on tie rods. Now the captive bolts can be fully tightened.

(7) Obtain the strut assembly with the attached split collar.

One strut has a painted red band to correspond with a red mark on the gear case. If this strut is attached to the leg on that paint-marked side of the case, the split collar will open on the side of the case bearing the hinge. The strut ends are forked to fit over lugs where tripod legs and tripod leg extensions are joined together and these forks are locked in place by captive pins and cotter pins.

b. Mast assembly. (1) Loosen nuts on hinged captive bolts at top of gear case and tilt bolts back. Remove triangular cover plate. Select lower half of hollow mast. Raise and hold it horizontally so that the hinge-half at its base engages the hinge-half on the gear case. Insert the long pin through the hinge LEAVING IT CHAINED TO THE SECTION OF RIGID COAXIAL LINE. (If mast were now tilted up its base would fit where cover plate had been.) A block and tackle is provided with a length of cable attached to each block. The shorter length terminates in an anchoring lug. Fit this into the slotted hole near the jack end of the upper web of a tripod leg extension. (Located on the same side of the gear case as the red paint mark.) Pass the longer length over the pulley up at the apex of the struts and slip its hook through the ring on the top of the lower section of the mast. Hold the lower section of mast in a horizontal position by pulling up slack of the block and tackle rope and snubbing it on the cleat provided on the tripod leg extension. Obtain the upper section of mast. Lift it to a horizontal position and bolt it with its lower flange against the top flange of the lower mast section.

(2) Remove antenna assembly from its packing case. Remove the three dipoles and six connecting cables from their case. Line up the hinged reflector sections and install the two struts to maintain this alignment. Mount the dipoles on the reflector. Connect each cable between a *dipole* receptacle and receptacle on the lobe switch box bearing the same number. Bolt the antenna assembly to the flange at the top of the mast while it is still in the horizontal position.

(3) Remove the cap from the rotary coupling. (Stow this cap under the cover plate and stow the plate on the stud provided on one of the tripod legs.) Push the cables up through the hollow mast and snap the coupling into its keyed position in the mast

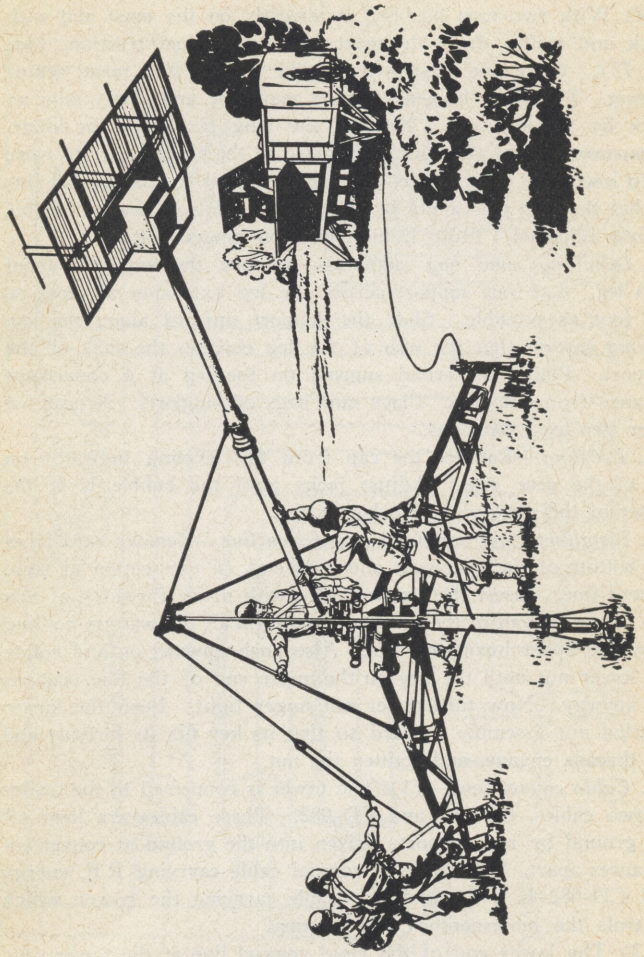

FIGURE 75.—Tower TR–24–A: Raising mast and antenna.

bottom. Open the door on the lobe switch box. Insert cable plugs into their proper receptacles and close the door.

(4) With two men pushing up directly on the mast and with block and tackle, draw the mast up to a vertical position, (see fig. 75). Close and fasten the collar around the mast center bearing. Swing up hinged bolts on gear case and partly take up slack by turning nuts. Remove the long pin from the hinge. ***Important:*** This pin *must* be inserted in the hinge either to raise or to lower the mast. It is purposely chained to the coaxial line so that the long pin cannot be used unless the rigid section of line is first removed. Fully tighten nuts on hinged bolts.

c. Installing sand bag supports.—Remove the supports from each leg. Lay one support across the leg extension as close to the foot as possible. Slide the support upward along the leg, making certain that the web of the leg engages the slots of the support. Place the second support on the leg at a convenient distance from the first. Place sand bags on supports. Repeat for other two leg extensions.

d. Leveling.—Remove the cap from the leveling indicator on top of the gear case. Adjust jacks until the bubble is in the center of the glass vial. Replace cover.

e. Installing rigid coaxial transmission line.—Remove caps from the bottom of the gear case and both ends of the section of rigid coaxial line. Insert the smaller end (with inside threads) of this line in the bottom of the gear case and push all the way up holding it by the upper hexagonal nut. Also push upward on and rotate the lower nut until the key on the upper end of the line engages the keyway. Now turn upper nut finger tight. Push the larger knurled nut assembly upward so that its key fits its keyway and the threads engage, and tighten the nut.

f. Cable connections.—(1) The tower is connected to the trailer by two cables, CD–981 and CD–982. These cables are kept off the ground by rod supports driven into the ground at convenient distances apart. CD–981 is a coaxial cable carrying R.F. energy and CD–982 is a 14 conductor cable carrying the power which controls the movement of the antenna.

(2) The lower end of the rigid coaxial line at the tower (fig. 76) is connected by CD–981 to the small coaxial receptacle in the TOWER JUNCTION BOX on the trailer (fig. 77). The 14

conductor receptacle on the side of the gear case (fig. 76) is connected by CD-982 to the 14 conductor receptacle in the TOWER JUNCTION BOX on the trailer (fig. 77).

g. Checking rotation of mast.—Remove hand crank from gear case. Remove cap from end of antenna motor housing and insert crank in the end of this housing (through hole in the tripod leg). Turn crank slowly to see if the mast and antenna rotate smoothly. When satisfied with rotations replace crank and protective cap.

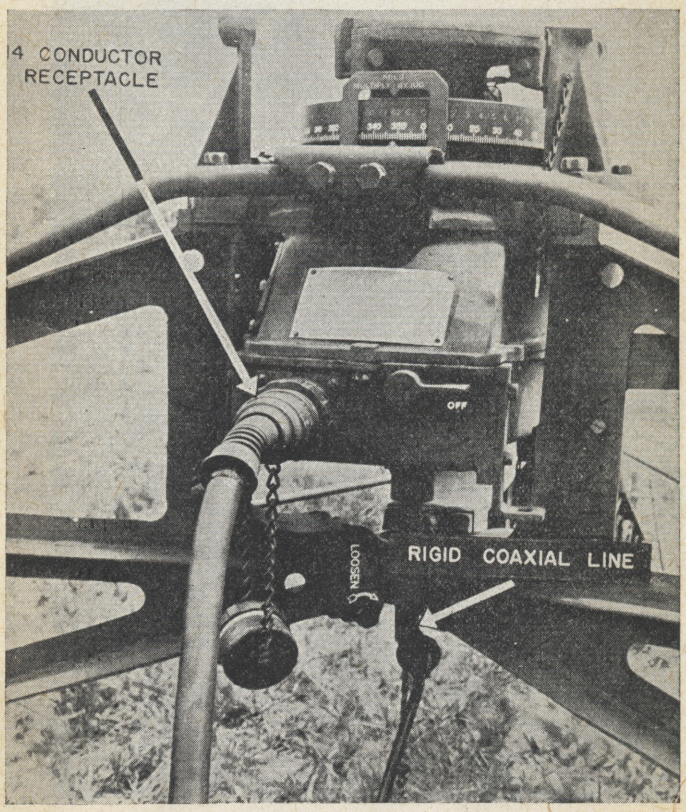

FIGURE 76.—Location of cable receptacles on gear box.

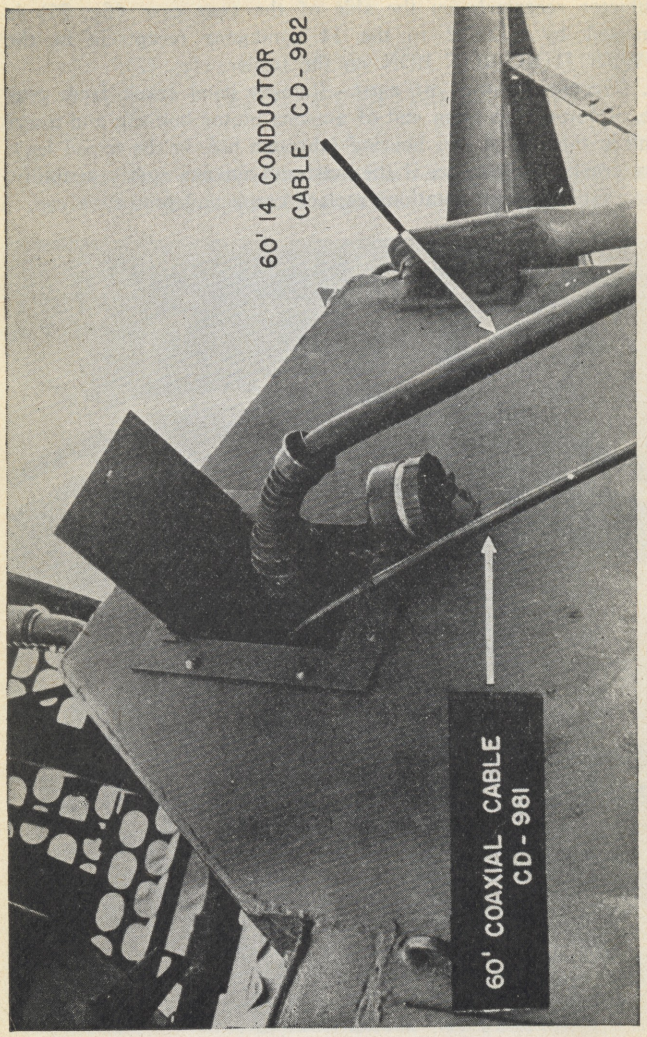

FIGURE 77.—Receptacles for IFF cables on SCR-545 trailer.

SECTION III

ADJUSTMENTS

■ 5. ADJUSTMENTS OF CONTROL UNIT.—*a.* Before power is turned on adjust certain controls on the panel of this unit as follows:

(1) At the midpoint of their rotational ranges; 100 K yd. CENT; 10 K yd. CENT; VERT. CENT.; INTENSITY and FOCUS.

(2) One third of the way clockwise in their rotational ranges; 100 K yd. GAIN and 10 K yd. GAIN.

(3) CALIB. extreme clockwise.

(4) SPREAD extreme counterclockwise.

b. Power is turned on and other adjustment then made as follows:

(1) Turn on switch marked IFF on power panel of SCR–545–A (provides power to IFF rack).

(2) Throw STANDBY-OPERATE switch to STANDBY.

(3) Set range selector switch (lower left hand corner) to the 100 K yd. position.

(4) Throw the ON-OFF switch to ON (pilot light comes on).

(5) Snap on FILAMENT VOLTAGE circuit breaker on power supply panel; wait 45 seconds; and then snap on PLATE VOLTAGE circuit breaker.

(6) Adjust FOCUS and INTENSITY as on radar scopes.

(7) Adjust 100 K yd. CENT. and 100 K yd. GAIN back and forth until the ends of the sweep are ⅛ inch from the sides of the screen.

(8) Turn range switch to CALIB. (A series of sine waves will appear on the screen.)

(9) Adjust CALIB. counterclockwise until just 12 complete cycles are visible.

(10) Turn the range switch to 10 K yd. position and adjust sweep length as in (7), using the 10 K yd. GAIN and the 10 K yd. CENT. Controls.

(11) Turn range switch to TEST. Also increase INTENSITY a little.

(12) Draw control unit forward on shelf to reveal plate on right lower side (not far enough for it to tilt forward on shelf).

(13) Remove plate and insert test cable No. 7 to bridge across jacks 120 and 121–6 and adjust potentiometer 93 (also located there) until a distinct sharp pulse appears at each extremity of the base line. Remove cable; restore cover; move unit back; and reduce intensity as needed for normal operation.

■ 6. ADJUSTMENTS OF TRANSMITTER.—*a.* Before the application of PLATE VOLTAGE:

Note. Measurements and adjustments of the frequency of the receiver and transmitter are not made while the SCR–545–A transmitter is operating. Therefore the RC–145–A is specially synchronized for these purposes by the calibrator 1–189–A which comes with the SCR–545–A. Connect it as follows: By test cable connect the TEST-SYNCH output of the calibrator to the TEST-SYNCH input of panel BD–125–A which is located at the left of the calibrator; turn on the calibrator as described in the SCR–545–A instruction book; on junction box 22–B in the cab of the SCR–545–A pull out the plug in the TERMINATION receptacle and plug it into the TEST-SYNCH receptacle; turn the range switch selector on the control unit to 100 K yd. *On the completion of adjustments and always for normal operation* be sure to return the plug to where it belongs in the TERMINATION receptacle.

(1) Snap FILAMENT VOLTAGE on the power supply to ON.

(2) Set the STANDBY-OPERATE switch on the control unit to STANDBY.

Note. Certain adjustments to follow are by screw driver. Use the one provided. It has a knurled knob and is screwed into the front panel above the receiver dials.

(3) Set POWER MEASUREMENT and BIAS full counterclockwise.

(4) Set POWER OUTPUT and WIDTH extreme clockwise.

(5) Set the four receiver dials and the transmitter dial (it is moved by the control marked PLATE) to the operating frequency desired. Be especially sure that DET. and OSC. are at the same dial settings.

(6) Disconnect cable from the ANTENNA "L" connector on panel; remove the "L" connector and in its place install "T"

connector; connect short antenna (on a right angle connector) to the top of the "T" connector; connect the dummy antenna to its bottom.

b. After the application of plate voltage:

(1) Next to the RC–145–A rack set up the test scope provided with the SCR–545–A. Connect the X input terminals of the scope to the SWEEP jack on the SCR–545–A search receiver test panel (also, if the scope has inputs for intensity modulation connect them to UNBLANK on the same test panel); turn on the test panel toggle switch; connect RECEIVER OUTPUT-LOW (on receiver and transmitter BC–1267–A) to the VERT INPUT posts of the scope; adjust focus and intensity; on the same test panel rotate SWEEP to position 3.

(2) Snap on PLATE VOLTAGE on power supply panel.

(3) With TEST SWITCH at Ic, adjust BIAS until the ammeter shows a reading slightly over zero—such as .25 M.A. Now move the STANDBY-OPERATE switch on the control unit to OPERATE. The reading should be 2.5 to 7 M.A.

(4) Turn TEST SWITCH to PO. The envelope of the main pulse will be seen on the control unit oscilloscope, and on the test oscilloscope. Adjust ANT (turn LOCK screw back before attempting this) and also adjust ANTENNA MATCHING-RCVR handle. Adjust both for maximum pulse height. Adjust this matching handle by pulling it out to the exact point of maximum pulse height and then restoring the rod into its sheath, without disturbing this adjustment, by pressing in the handle button.

(5) With the pulse still on the screen, WIDTH is adjusted: Set the sweep switch on the search receiver test panel of the SCR–545–A to position 2 (sweep of 18 microseconds). Adjust WIDTH until pulse occupies from ⅓ to ½ the length of the sweep (pulse width 6–9 microseconds). Set STANDBY-OPERATE to STANDBY. At any time when the monitor pulse envelope is on the screen, transmitter power output can be checked. Turn POWER MEASUREMENT clockwise until the pulse just disappears. Then read kilowatts directly on the meter. POWER OUTPUT controls kilowatts of output. About ½ kilowatt is satisfactory. If you do check output, afterwards don't omit final switch setting of STANDBY-OPERATE switch to STANDBY. Also set TEST switch to OPERATE.

(6) Connect the signal generator to an A.C. power outlet; set ON-OFF toggle switch to ON; turn TEST-CRYSTAL switch to CRYSTAL; allow 15 minutes to warm; turn RANGE SWITCH to H. F. position; plug head phones into jack marked PHONES.

(7) Open cover on right side of signal generator (sometimes called frequency meter) panel. Two dial calibration charts are inside it. Find the *red calibration numerals,* on the high frequency chart, nearest in frequency to the frequency to which the receiver and transmitter are to be tuned. Set the generator tuning dial to the dial setting indicated on the chart (a red number) using the TUNING control. Now listen for zero beat in the phones as the CALIBRATE knob is turned slowly back and forth, and stop on the point of zero beat. This calibrates the tuning dial of the frequency meter. Now move the same tuning dial to the reading indicated by the same calibration chart, for the actual frequency desired for the transmitter and the receiver.

(8) Proceed as follows to tune the transmitter to the desired frequency. Snap the STANDBY-OPERATE switch on the control unit to OPERATE turn AUDIO GAIN of the generator full clockwise; rotate TEST-CRYSTAL switch to TEST; open the antenna door on top of the signal generator and pull out the antenna rod. A loud audio signal will be heard in the phones. It is the signal of the pulse repetition rate of the IFF transmitter and now is too strong to permit successful use of the frequency meter. To reduce it slide the antenna rod down into the case until a very weak signal is obtained. Don't alter the transmitter dial setting from the desired frequency. Then turn PLATE ADJUSTMENT until a rasping noise is heard in the phones of the frequency meter. This indicates that the transmitter is operating at the desired frequency. Repeat (4) above. Turn STANDBY-OPERATE switch of the control unit to STANDBY. Do not alter the signal generator frequency setting.

■ 7. ADJUSTMENT OF RECEIVER.—*a.* With the STANDBY-OPERATE switch at the control unit at STANDBY and the signal generator frequency setting the same as in paragraph 6*b*(8) proceed to tune the receiver as follows:

(1) Connect the R.F. test cable (it has a "selecter" fitting at

each end) between R.F. OUTPUT of the generator and the top branch of the "T" connector (from which the short antenna must first be removed).

(2) Turn SENSITIVITY on control unit to maximum and adjust the four receiver dials starting with OSC. at the right and working back one by one to the left dial, for maximum closure of the tuning eye. If it closes too far (overlaps), reduce MICROVOLTS on the generator (fine and coarse adjustments available) or reduce SENSITIVITY on the control unit.

(3) Adjust ANTENNA MATCHING, TRANS (to prevent received energy from entering transmitter) handle by pulling it out to the exact point of maximum tuning eye closure. Then restore the rod in its sheath without disturbing this adjustment, by pressing in the handle button.

■ 8. CHECK PROCEDURES.—It is advisable to recheck receiver and transmitter tuning and matching and to repeat adjustment 6*b*(4) several times back and forth. These adjustments affect each other. Be careful to properly use the short antenna and the R.F. cable and NEVER TURN STANDBY-OPERATE to OPERATE if the R.F. TEST CABLE IS IN PLACE. Remove "T" connector and restore cable CE–1008. The real line and antenna are in place instead of the dummy. Therefore it is again advisable to recheck the adjustment of ANT. and ANTENNA MATCHING RCVR. Disconnect the calibrator and be sure to restore the plug which originally was in the TERMINATION receptacle of JB 22–B. Disconnect the test scope and shut off the test panel.

■ 9. ADJUSTMENTS OF INDICATOR UNIT.—*a.* Snap on INDICATOR PANEL switch; wait for the MOUNT DISPLACEMENT tuning eye on the remote indicator to become bright; turn AZIMUTH control back and forth for point of minimum eye opening; adjust EYE OPENING so that the eye is just closed with no overlap.

b. With AZIMUTH still at closed-eye setting turn CENTERING back and forth and listen for two relay clicks close together. Adjust slowly for the mid-point between them.

(Alternate method if trailer is too noisy: Turn SENSITIV-

ITY full clockwise and turn ON the ANTENNA MOTOR switch. The antenna will oscillate in azimuth or may even go round and round, and the eye opening will continually open and close. Adjust centering so that the antenna does oscillate and the successive eye openings are equal.)

c. Turn SENSITIVITY full clockwise for maximum antenna oscillations. Slowly turn it back until the oscillations are just eliminated.

d. Check the antenna for direction of rotation by moving the AZIMUTH knob. If wrong, the radar repairman should make necessary corrections.

SECTION IV

ORIENTATION AND SYNCHRONIZATION

■ 10. ORIENTATION.—Rotate the radar antenna until its telescope sights on the mast of the IFF antenna. With the hand crank rotate the IFF antenna until it is facing away from the radar mount. Now rotate it in a clockwise direction until the observer at the radar telescope is able to sight along the edge of the IFF antenna reflector. Loosen the long hexagonal bolt above the IFF azimuth ring on the gear case, and rotate it to read a value equal to the azimuth reading of the radar antenna plus an added 90°. Look at the chart on the door of the antenna junction box. It will show further corrections to be used when certain operating frequencies are used. Read off the appropriate correction and add it to or subtract it from the setting just made. Tighten the bolt.

■ 11. SYNCHRONIZATION.—Snap on INDICATOR PANEL and ANTENNA MOTOR SWITCHES; wait for the antenna to come to rest and turn off ANTENNA MOTOR. Hold AZIMUTH control firmly at point of minimum eye opening and, at the same time, press in ZERO ADJUSTMENT knob and rotate it until the indicator dial reads the same as the azimuth ring on the gear case. Check to be sure that the eye opening is still at minimum. If not, reset it by AZIMUTH knob and repeat.

SECTION V
OPERATION

■ 12. OPERATING PROCEDURE.—*a.* Put the SCR–545–A into operation.

b. Throw IFF switch on the SCR–545–A switchboard to ON.

c. Throw ON-OFF switch on the control unit to ON. Throw blower switch on Rack FM–79 to ON.

d. Throw FILAMENT VOLTAGE switch on power supply to ON; wait 45 seconds; turn on PLATE VOLTAGE.

e. Turn on the INDICATOR PANEL, ANTENNA MOTOR, and LOBE SWITCH MOTOR switches on the indicator.

f. Set SENSITIVITY to produce a small amount of grass.

g. The radar azimuth tracker reports the azimuth of the target to be challenged.

h. Set the IFF azimuth dial to agree with *g* above. Note by the closing of the azimuth tuning eye, that the antenna has moved to the proper azimuth. Set SPREAD fully counterclockwise.

i. If the radar has the target in the range notch, set the range switch on the control unit to 10 K yds. Turn STANDBY-OPERATE switch to OPERATE. Look for a reply pulse at the left end of the sweep. Manipulating SENSITIVITY control may help in seeing pulse. The reply may not be exactly at the left end of the sweep due to some time delay between reading the radar azimuth and setting the same azimuth on the IFF dial.

j. If the target spotted by radar is beyond 44,000 yards the range switch should be set at 100 K yds. Then, to be identified as friendly, the reply pulse must be at the same range as that on the radar oscilloscopes (these ranges must both be estimated from their position along the sweeps).

k. If a reply pulse appears, turn the SPREAD control clockwise to produce two images. If the images match in height proceed to step *l*.

(NOTE: Adjust receiver SENSITIVITY below saturation until it is possible to match pulse heights.)

l. Return the SPREAD control to its extreme counterclockwise position and wait a sufficient length of time for the appearance of a complete code group so as to observe the code used in answering.

m. If range (step *i*), azimuth (step *k*) and coding (step *l*) are correct, the challenged plane is considered friendly.

n. Move STANDBY-OPERATE switch to STANDBY.

■ 13. REPORTS.—The IFF operator (the range operator of the SCR–545–A) will normally interrogate any target picked up. His report will vary with the response received.

a. If the response is as in 12*m* above, he reports "IFF clear" into the net telephone.

b. If the target returns an improperly coded response, or one unintelligible for any reason he reports "IFF unknown" into the net telephone.

c. If there is no response or one with pips badly mismatched or one at the wrong range, he reports "No IFF" into the net telephone.

■ 14. SHUT-DOWN PROCEDURE.—*a.* Throw ON-OFF switch on the control unit to OFF.

b. Throw power supply PLATE VOLTAGE and then FILAMENT VOLTAGE off.

c. Throw the IFF switch on SCR–545–A switchboard off.

SECTION VI

DRILL

■ 15. COMMANDS EMPLOYED.—*a.* After the SCR–545 has been placed in operation, the command employed to emplace the RC–145–A antenna assembly, and tower at a new location is: EMPLACE.

b. The command for disassembly is: MARCH ORDER.

■ 16. EMPLACE.—**8** commands: EMPLACE.

5, 6, 7, 8 Remove tarpaulin, the two rear trailer tarpaulin bows and the forward tarpaulin bow (figs. 78 and 79).

7, 8 Open the tail gate of the trailer (fig. 80).

5, 6 take cables CD–981 and CD–982 from chest CH–226 on SCR–545 trailer.

7, 8 unfasten and remove the rear trailer rack (see figs. 80 and 81).

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5, 6, 7, 8 Loosen the four webbed straps holding antenna cradle CH–232 and remove it from the trailer (see fig. 80).

7, 8 Remove the webbed straps which hold chest CH–224 (see fig. 81).

5, 6, 7, 8 Unlatch the forward trailer rack and remove the right, left and forward side racks (see fig. 81).

5, 6 Remove the canvas bag from trailer.

7 Removes the steel tie rods from trailer (see fig. 82).

8 Removes the straps holding the ends of the tripod legs. He loosens the bolt and nut fastening the flange collar of the tripod and removes the tripod from trailer (see fig. 82).

6 Removes the upper section of the antenna column from trailer (see fig. 82).

5, 6, 7, 8 Remove chest CH–224 (see fig. 82).

5, 6 Remove blocks A and B from the trailer (see fig. 83).

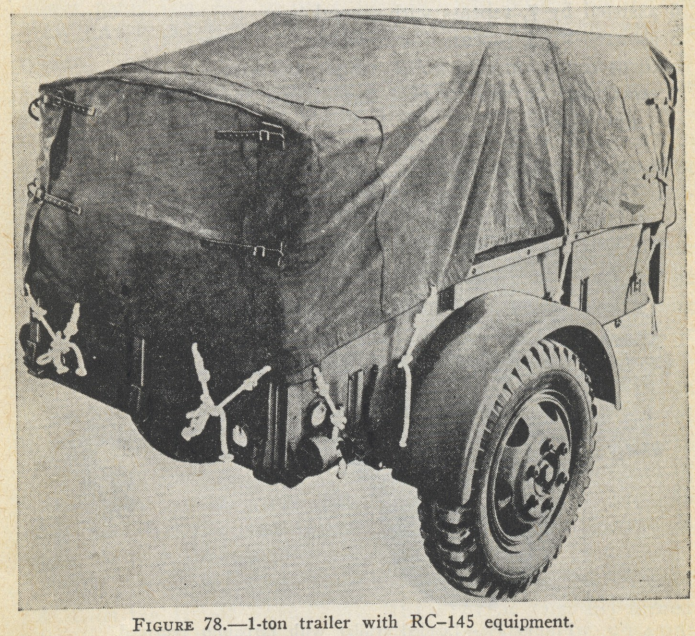

FIGURE 78.—1-ton trailer with RC–145 equipment.

5, 6, 7, 8 Lift the gear case out of the trailer (see fig. 84).
5, 6, 7 Remove blocks F, E and D (see fig. 84).
5, 6, 7 Remove the three inner sections of the tower legs from trailer (see fig. 85).
5, 6, 7, 8 Lift Chest CH–225 from the trailer (see fig. 85).
8 Removes blocks G (see fig. 86).
5, 6, 7 Remove the three extension legs and turn their cam bolts full clockwise (see fig. 86).
8 Lifts the lower section of the antenna column from trailer (see fig. 86).
5, 6, 7, 8 Lift chest CH–222 from the trailer.
8 takes tripod leg with collar, holding collar 1 foot above ground.
5 hooks a second tripod leg to a bolt on the collar.
6 repeats with third leg.
8 assisted by **5**, engages tripod leg extension to first tripod leg.
6 assisted by **7**, repeats with second leg.
8 assisted by **5**, repeats for third leg.
6 turns extension cam bolts counterclockwise.
7 straddles the end of first leg. Lifts, inserts, and locks jacks into place.

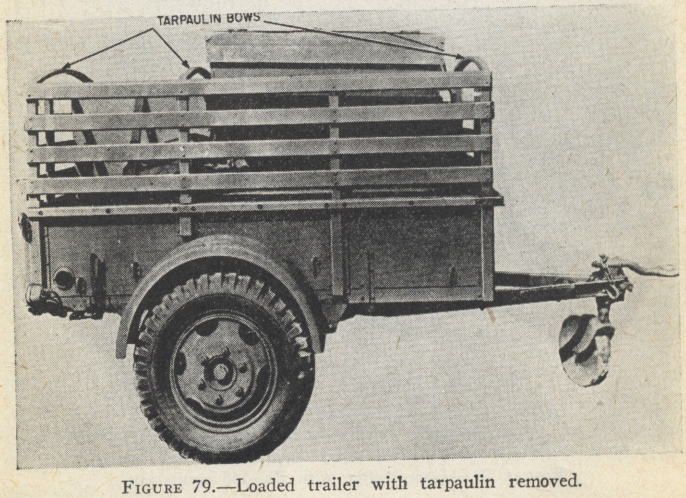

FIGURE 79.—Loaded trailer with tarpaulin removed.

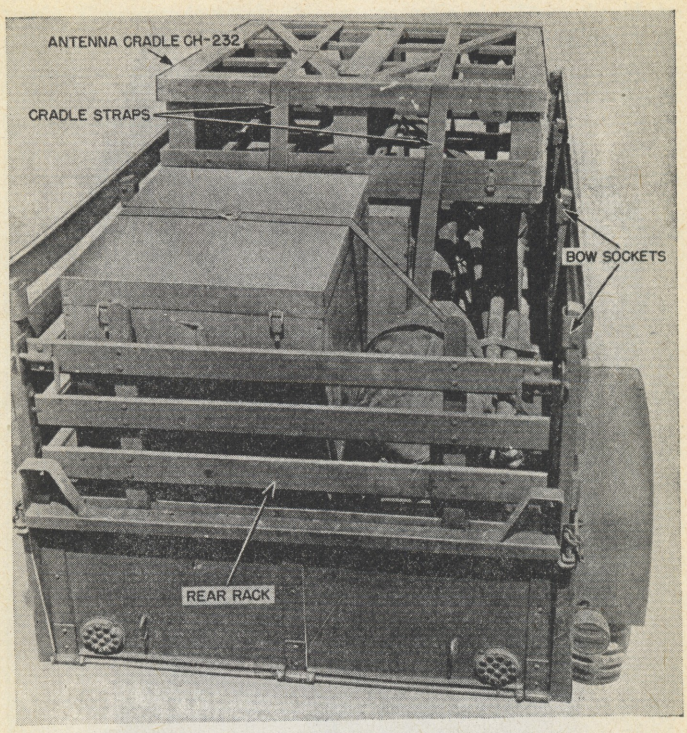

FIGURE 80.—Position of antenna cradle and cradle straps.

8 repeats with second leg.
5 repeats with third leg.
6 installs tie rods loosely in leg extensions.
8, 5, 6, and **7** lift gear case and insert in recess in tripod.
5, 6, 7, directed by **8**, engage case with locating pins and start captive bolts.
6 tightens turnbuckle on tie rod.
8, 5, 7 tighten captive bolts on gear case.
8 raises split collar aligning the red paint mark on one strut with the red paint mark on gear case.

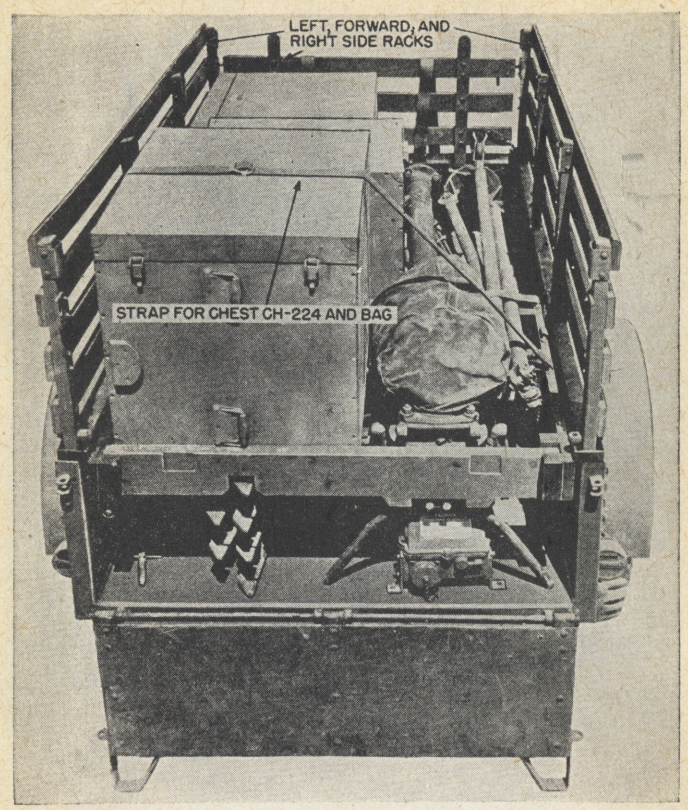

FIGURE 81.—Position of chest CH–224 and canvas bag.

5, 6, 7, engage strut forks with tripod legs.
8 removes cover plate and long pin at top of gear case.
5 at the direction of **8,** inserts lower half of mast into hinge on gear case.
8 inserts long pin.
6, 7 install block and tackle, raise lower half of mast to horizontal position, and make fast to cleat on tripod.

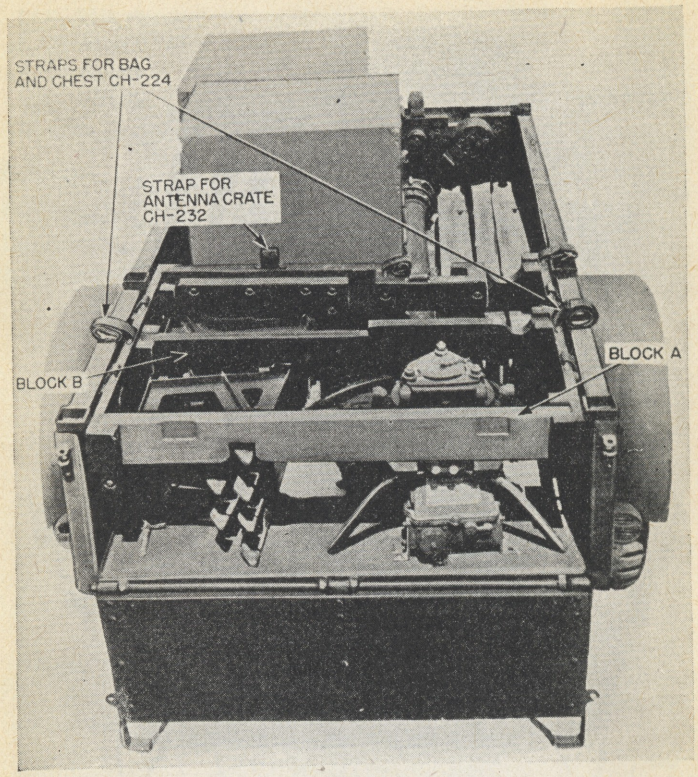

FIGURE 83.—Location of blocks A and B.

8, 5 hoist antenna with block and tackle.
6 closes and fastens split collar around bearing.
6, 7 unreel cables CD–981 and CD–982 between antenna and radar.
8, 5 remove block and tackle.
5 swings up bolts which hold mast to gear case; removes long pin and tightens nuts.
8 removes caps from co-axial line and installs line in bottom of gear case. He then attaches cable CD–981.

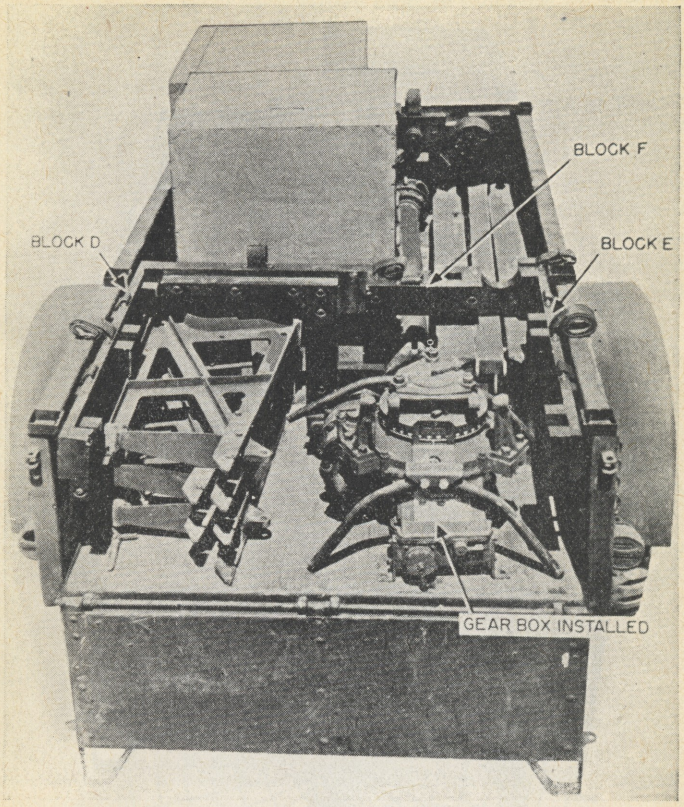

FIGURE 84.—Location of blocks D, E and F.

5 removes cap on gear case and connects cable CD-982.
8 inserts hand crank and tests for proper rotation of mast.
6, 7 connect cables CD-981 and CD-982 at radar.

■ 17. MARCH ORDER.—8 commands: MARCH ORDER.
6, 7 connect cables CD-981 and CD-982 from radar.

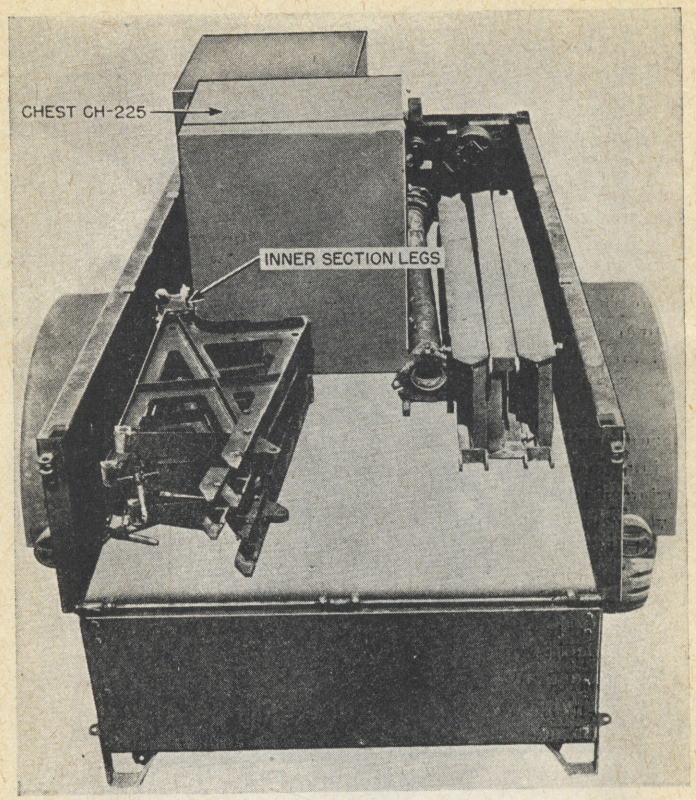

FIGURE 85.—Chest CH–225 and inner section legs in position.

5 disconnects cable CD–982 from gear case, installs cap.
8 removes cable CD–981 from rigid co-axial line and co-axial line from gear case and places caps on its ends.
5 loosens nuts on hinged bolts on top of gear case; installs long pin; and swings back the hinged bolts.
6, 7 reel up cables CD–981 and CD–982.
8, 5 install block and tackle and take up slack rope.

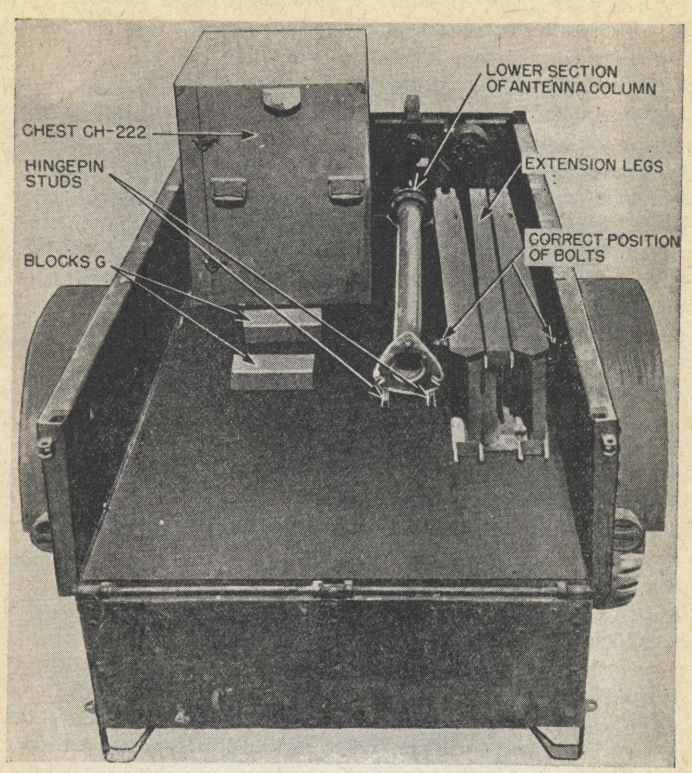

FIGURE 86.—Location of blocks G.

6 unfastens split collar from center bearing on mast.

8, 5 lower antenna with block and tackle and snub rope about cleat to hold it horizontal.

6, 7 assist **8** and **5** in lowering antenna by holding it up avoiding any sudden drop.

7 disconnects plugs from receptacles in lobe switch box; pulls out coupling from mast bottom; and removes cables from mast.

6 unbolts antenna as **8** and **5** hold it in place.

6, 7 disassemble antenna assembly and place parts in packing cases.
5 unbolts upper section of mast while **8** holds it up.
8 carries upper section of mast out of the way.
6, 7 lower the lower half of the mast to the ground and remove the block and tackle.
8 removes long pin.
5 lifts lower mast section from hinge on gear case.
8 installs cover plate and long pin into top of gear case.
8, 6, 7 remove split collar and struts assembly and lay to one side.
8, 5, 7 loosen captive bolts holding gear case in position.
6 loosens turnbuckle on tie rod.
8, 5, 6, 7 lift gear case from recess in tripod.
6 removes tie rods.
7 straddles the end of first leg of tripod; lifts it; unlocks jack; and removes jack.
8 repeats for second leg.
5 repeats for third leg.
6 turns extension cam bolts clockwise.
8 assisted by **5** disconnects tripod leg extension from first tripod leg.
6 assisted by **7** repeats with second leg.
8 assisted by **5** repeats with third leg.
8 holds up tripod leg with collar.
5 unhooks second tripod leg from bolt on the collar.
6 unhooks third leg.
5, 6, 7, 8 strip the trailer of all its accessories such as the tarpaulin bows, front rack, side racks, and the rear rack. (See fig. 87.)
5 installs block C at the front end of the trailer as shown in fig. 87. The rectangular steel collars should be placed directly over the stake pockets.
5, 6, 7, 8 set Chest CH–222 in the forward left-hand corner tight against block C, with the carrying handles to the front and rear and the cover toward the outside of the trailer. (See fig. 86.)
6 places the lower section of the antenna column in the groove provided on block C, with the hinge-pin studs resting on the floor boards. (See fig. 86.)

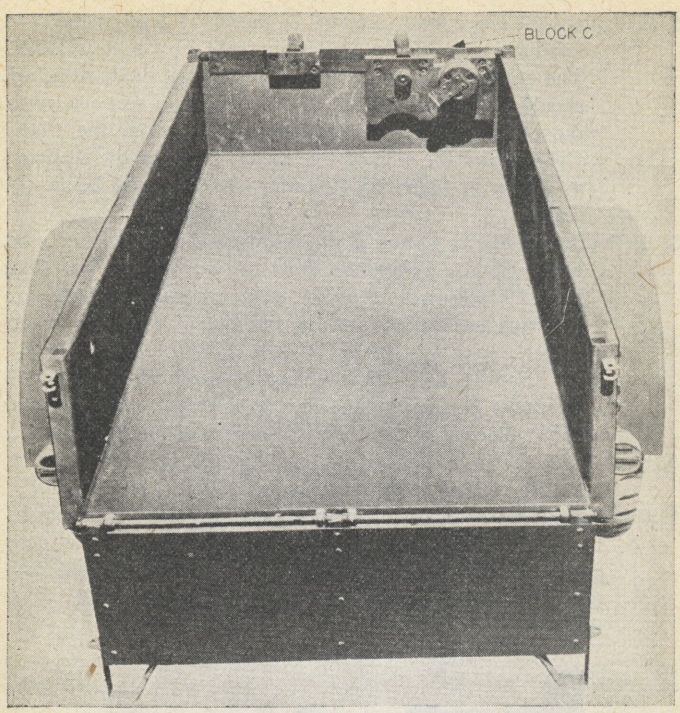

FIGURE 87.—Two-wheel trailer with block C installed.

5, 7, 8 set the three extension legs on the right-hand side of the trailer with the narrow ends up against the front of the trailer and under the groove on block C. The outer legs should have the hinge bolts up. (See fig. 86.)

6 lays the blocks G on the trailer bed approximately 6 inches on Chest CH–222. (See fig. 86.)

5, 6, 7, 8 place Chest CH–225 on the two wooden blocks G (fig. 85), with the carrying handles toward the sides of the trailer and the cover toward the rear. Place Chest CH–225 solidly against Chest CH–222 and close to the upper column, leaving space between the chest and trailer side for the inner section of the tower legs.

5, 6, 7 place the three inner sections of the tower legs on the rear left-hand side of the trailer in front of Chest CH–225. The section with the collar and eccentric bolts attached should be placed on top of the other two sections, with the collar end fitted into the space between the Chest CH–225 and the side of the trailer. Stagger the sections, as shown in figure 85, in order that they will be firmly seated.

5, 6, 7 (Before blocks D and E are installed, they will have to be arranged for either the steel or wooden trailer. The hinged blocks will be on the inside of the side pieces for the wooden trailer, and on the outside for the metal trailer. (See figs. 88 and 89.)). Install blocks D, E, and F. (See fig. 84.) The rectangular steel collars attached to blocks D and E must line up with the stake pockets. Insert block F in the forward channel of blocks D and E.

5, 6, 7, 8 set the gear case on the remaining free floor space at the rear right-hand corner of trailer. (See fig. 83.)

5, 6 install blocks A and B in the channels provided on the blocks D and E. These sections have cut-outs to fit over the gear case and the inner legs. This holds them in place and prevents shifting from side to side while in transit. (See fig. 83.)

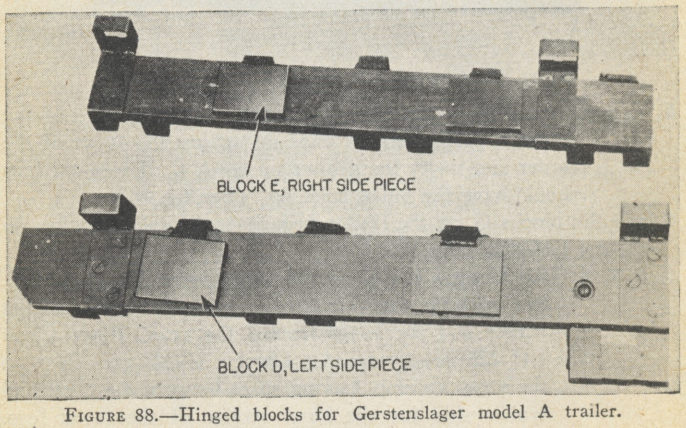

FIGURE 88.—Hinged blocks for Gerstenslager model A trailer.

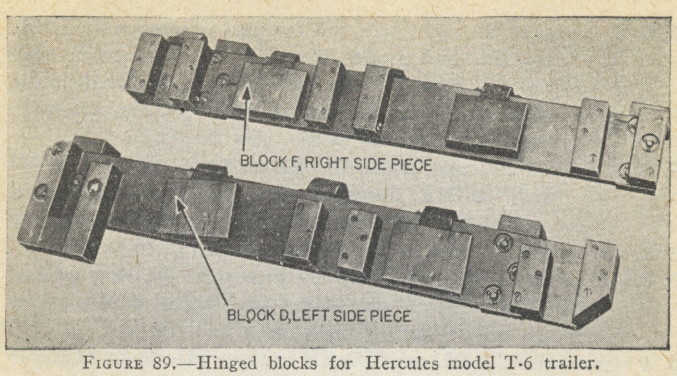

FIGURE 89.—Hinged blocks for Hercules model T-6 trailer.

5, 6, 7, 8 set Chest CH–224 over the inner legs in the cut-out portion of block B and on the supporting shoulders attached to blocks A and F. (See fig. 82.)

6 Places the upper section of the antenna column on the right side of Chests CH–222 and CH–225, mounting the small flanged end of the upper antenna column on the small collar attached to block C. Drops the other end of the column having the larger flange into the slot provided on block F. (See fig. 82.)

7 Installs the tripod next. Folds the tripod legs, opens the split flanged collar at the upper end of tripod, and mounts the tripod over the collar attached to block C. Closes the flange collar and secures with the bolt and nut. (See fig. 82.) Fastens the other end of the tripod with the short webbed straps attached to blocks E and F. These same straps pass over the flange of the upper section of the antenna column and hold it in place.

7 Ties the three steel tie-rods together with light rope and places them on the extension legs between the tripod and the upper section of the antenna column. (See fig. 82.) Two of these rods are linked together, while the third rod has a turnbuckle. When disassembled, one section is separated. They are used with the tower legs.

5, 6 set the canvas bag over the gear case and across blocks A and B. (See fig. 81.)

5, 6, 7, 8 replace the right, left, and forward side racks by inserting the rack stakes through the rectangular steel collars attached to blocks D and E and into the stake pockets. Fasten the forward trailer rack in place with the latches and side bolts. (See fig. 81.)

5, 6, 7, 8 place Antenna Cradle CH–232 on top of Chests CH–222 and CH–225. Secure in place with the four webbed straps. Two of these straps are attached to block C and are attached to block F. (See fig. 80.)

7, 8 anchor down Chest CH–224 by means of the long webbed straps fastened to blocks D and E. This strap also passes over the canvas bag. (See fig. 80.)

5, 6 stow cables CD–981 and CD–982 in chest CH–226 in SCR–545 trailer.

7, 8 fasten the rear trailer rack in place with the latches and sliding bolts provided. (See fig. 80.)

7, 8 close the tail gate, and lock it in place with the pins provided for this purpose. (See fig. 80.)

5, 6, 7, 8 install the two rear trailer tarpaulin bows and the forward tarpaulin bow. (See fig. 79.)

5, 6, 7, 8 place the tarpaulin over the equipment and anchor it with the attached straps and ropes. (See fig. 78.)

APPENDIX XI

MULTIPLE TARGET OSCILLOSCOPE INTERPRETATION

(This appendix will be published at a later date.)

APPENDIX XII

LIST OF REFERENCES

1. PUBLICATIONS.

Camouflage	FM 5–20
Director M7	FM 44–36, 4–136, TM 9–658
Director M9 and M10	FM 44–38, 4–138, TM 9–671
Electrical fundamentals	TM 1–455
Employment of antiaircraft guns	FM 44–4 (now published as 4–104)
Field fortification	FM 5–15
Fire control for AA guns	FM 44–21 (now published as 4–121)
Formations and inspections	FM 4–120
Gunnery, antiaircraft	FM 44–10 (now published as 4–110)
List of—	
Publications	FM 21–6
Training films and Film strips	FM 21–7
Organization and tactics	FM 44–1 (now published as 4–100)
Radar electronic fundamentals	TM 11–466
Radar system fundamentals	TM 11–467
Radio equipment RC–145	TM 11–1331, 11–1431, 11–1531
Radio fundamentals	TM 11–455
SCR 545–A	TM 11–1327, 11–1427, 11–1527

2. TRAINING FILMS.

Oscilloscope target interpretation	TF 11–1082
Radar, principles of operation	TF 4–1102
Radar, spotting of trial fire	TF 4–1363
Siting of gun laying radar sets	TF 4–1323

3. FILM STRIPS.

Field fortifications for antiaircraft artillery, Part III—Guns	FS 4–202 (now published as)
Radar theory	FS 4–124 (now published as)
SCR–545, general description and nomenclature, exterior	FS 4–230 (now published as)
SCR–545, general description and nomenclature, interior	FS 4–231 (now published as)
SCR–545, prepare for action and close station	FS 4–232 (now published as)

4. FILM BULLETINS.

Radio set SCR–545	FB 87 (now published as)

[AG 300.7 (30 Sep 44).]

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IC 4: T/O & E 4–87;
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For explanation of symbols, see FM 21–6.

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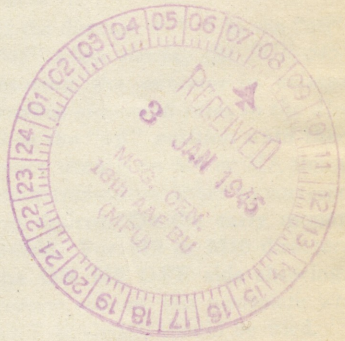
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